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VI.—THE BRITISH SPECIES OF PHOMOPSIS.

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(With Plates.)

Saccardo, in his *Sylloge*, 1884, vol. iii, p. 66, suggested that one of the sections into which the vast genus *Phoma* could conveniently be subdivided might be called *Phomopsis*—"perithecio subastomo depresso, basidiis demum uncinatis"—and added that the species of this section were probably all spermogonia of the ascophorous genus *Diaporthe*. At that time the real basis of this subdivision was imperfectly understood; it has since been worked out more fully, especially by Diedicke (*Annal. Mycol.*, 1911, ix. 8), and it is now seen that, so far from being a section of *Phoma* separated by only slight differences, *Phomopsis* is in fact a very distinct genus with well-marked characters.

The typical pycnidium of *Phoma* is somewhat globose or lens-shaped, thin-walled, formed of rather loose olivaceous-brown or blackish pseudoparenchymatous tissue, which is only one or two cells thick and surrounds the pycnidial cavity similarly on all sides. It has a more or less marked ostiole or pore, often papillate, through which, when placed in water, the mature spores issue in those long curling strings with which all micro-mycologists are familiar, while the sporophores are very short, oftentimes barely perceptible or in age totally obsolete.

The typical *Phomopsis*, on the contrary, is rarely or never globose, when mature, and has the internal cavity enclosed by a heterogeneous wall; for it is floored below by a "proliferous stratum" several cells thick, composed of very minute faintly-coloured cells, while the upper half, in its perfect state, is roofed by a dense layer, also many cells thick, of very dark minute closely-packed cells, pierced usually about the summit by an ostiolar passage, often wide and irregular, which does not allow the spores to issue forth in curling tendrils with the same regularity as in *Phoma*. The sporophores which line the interior are long, flexuous, subulate, acicular, or cylindrical, densely crowded and much more permanent than those of *Phoma*; many of them, in fact, can always be seen under the microscope with the single apical spore still attached. The spores are lanceolate- or oblong-fusoid, more or less acute at the ends, hyaline,

most often biguttulate, and seldom exceeding 10μ in length or 4μ in breadth; the guttules also are generally small compared with the size of the spore, much more so than in the average spore of *Phoma*, and they are also more distant from the extreme ends than is usual in that genus. The cavity of the pycnidium is sometimes more or less divided into spurious chambers by inward protrusions of the proliferous stratum, but this is not universal or essential, and is found also occasionally in *Phoma*. When these protrusions become more decided the genus *Phomopsis* verges upon *Fusicoccum*, but this latter has typically larger spores. It would be a mistake, however, to merge the two genera into one; the idea prevalent in some quarters that valid genera must always be demarcated by unmistakable characters is a survival from pre-Darwinian times.

One more peculiarity of *Phomopsis* is hinted at in Saccardo's words "basidiis uncinatis." When the contents of a crushed pycnidium are examined, there are often found among the typical spores some long filiform bodies which are more or less curved or arcuate, or hooked at one end after the fashion of a walking-stick. Saccardo considered these to be the sporophores (basidia), although how spores could legitimately be borne on the down-turned ends of such supports he did not explain. Other investigators have described them as a second kind of spore, exactly similar to those assigned to the genus *Phlyctaena*. It seems probable that both explanations are correct; that is to say, there is in some species of *Phomopsis*, if not in all, a second filiform kind of spore, borne on sporophores, which are in general shorter than those which bear the fusoid spores, but also the long acicular sporophores of the latter can break away from the hymenium, and then become more curved than when *in situ*, or even hooked. Diedicke called the typical fusoid spores the A-spores, and the long filiform ones the B-spores. Von Höhnelt separated those few species in which both forms of spore were known to occur into the genus *Myxolibertella*, but it is better to consider these as merely a part of *Phomopsis*. When the B-spores occur, a section shows them in serried ranks, standing more or less parallel and erect on their sporophores; when only a few filiform structures are seen scattered among the fusoid spores, they are usually nothing but the transformed sporophores.

The following species may be considered to have both A- and B-spores:—

<i>P. ambigua</i> (<i>P. Mali</i>).	<i>P. Loniceræ.</i>
<i>P. Arctii.</i>	<i>P. petiolorum.</i>
<i>P. aucubicola.</i>	<i>P. Phytolacææ.</i>
<i>P. Cacti.</i>	<i>P. Ryckholtii.</i>
<i>P. Coronillæ.</i>	<i>P. scobina.</i>
<i>P. cryptica.</i>	<i>P. Solani.</i>
<i>P. Dulcamaræ.</i>	<i>P. Sophoræ.</i>
<i>P. Herminieræ.</i>	<i>P. tamicola.</i>
<i>P. japonica.</i>	<i>P. velata.</i>

Diedicke asserts that the A-spores are always borne on long sporophores, and the B-spores on special shorter ones, without intermediate links. Bubák states that the A-spores are on nar-

row ampulliform sporophores, and the B-spores on short thickish conical ones. Von Höhnelt finds the sporophores more or less alike in both cases. The latter statement seems to represent the truth in most of the cases here investigated, though the B-spores always have shorter sporophores. Diedicke also tries to make out that the A-spores occur in pycnidia of a different shape from those containing the B-spores, but for this contention there seems to be little or no ground.

The description given above of the mature pycnidium would be misleading without further explanation. For, when the pycnidium is young, it may be incomplete above; in fact, in that case in some species the fungus would seem to belong to the *Melanconiales*, being much of the nature of a *Gloeosporium*. It is this state which Von Höhnelt describes, and it may contain either A- or B-spores. At this time, however, the epidermis of the host is usually stained brown above the proliferous stratum, as one may find it in some states of *Leptothyrium* when their shield-shaped pycnidium is as yet imperfect. It is generally not till later that the thick pycnidial wall which surrounds the mouth of the *Phomopsis* is fully formed; in the end, again, this thickened mass sometimes easily drops out, leaving merely a pale cavity in the tissue lined with the spores and sporophores. The discoloured area of the epidermis is in many species of *Phomopsis* clearly visible as a halo round the ostiole of the fungus.

The belief that the species of this form-genus are pycnidial stages of *Diaporthe* is founded chiefly upon the fact that some of them, e.g., *Diaporthe Arctii*, are found habitually with the two states in close association; and in certain other cases the groups of pycnidia are often surrounded by that same sinuous dark line (marking the outer boundary of a patch of mycelium) which is characteristic of certain sections of *Diaporthe*. Proofs by culture seem to be altogether non-existent, but more than half of the British species can be reasonably connected with the genus, on one or both of these two grounds.

Hitherto *Phomopsis* has been ignored by all British mycologists, but during the past year the large number of British specimens preserved in the Herbarium at Kew under the genus *Phoma* have been examined, with the result that the following species of *Phomopsis* are found to occur in this country. The names are arranged alphabetically. Only the spores and sporophores, of which knowledge has been very imperfect, are in general described here, as the macroscopic aspect is usually correctly given in the original account, but complete descriptions will appear in a work on the British *Coelomycetes*, i.e., *Sphaeropsidales* and *Melanconiales*, now in course of preparation. There are in the Herbarium also many foreign species belonging to the genus, but at present classed under *Phoma*, which it is hoped to treat in a similar manner at a later date. In what follows localities are given only when the species has not been previously recognised as British. Some proposed new species are added at the end.

Phomopsis, Sacc. Annal. Mycol. 1905, iii. 166.

Pycnidia lens-shaped, conical, pustular, or rarely subglobose,

usually depressed and with a broader base; when mature, texture everywhere several cells thick, below more or less hyaline, but tinged in the lower layers with pale olivaceous or smoke colour, above thicker, darker and brown or blackish towards the outside; provided with a decided ostiole or merely pierced by a pore, sometimes even mouthless, or opening by a slit or irregular orifice; internal cavity more or less divided at times by protrusions of the proliferous layer. Spores mostly fusoid with subacute extremities, but occasionally tending towards ellipsoid with narrowed ends, or even oblong, usually biguttulate, hyaline; sporophores filiform, linear, subulate, or ampulliform, when long often curved, usually longer than the spores, densely crowded and more or less permanent.

Besides these A-spores, a few species produce also, usually in younger and less perfect pycnidia, but sometimes in similar or even in the same pycnidia, another spore-form, on sporophores which can be more or less like those just mentioned, though generally shorter and at times very short and papilliform. These B-spores are long and filiform, often curved, arcuate, S-shaped, or hooked at the upper end like a walking-stick. Many species assigned to *Phlyctaena* are nothing but the pycnidia containing the B-spores, see Nos. 28, 58, 67, 68, 76.

The two most distinctive features of the genus *Phomopsis* are (1) the permanent sporophores, (2) the nature of the pycnidium, which bears little resemblance to that of a typical *Phoma*, and in fact is so different that a practised eye can often distinguish them with a hand-lens or even without assistance.

The chief accounts of the genus given since Saccardo are:—

Diedicke, Kryptogamenflora der Mark Brandenburg, Pilze, vol. ix, p. 238.

Diedicke, Annal. Mycol., 1911, ix. 8, "Die Gattung *Phomopsis*," with plates 1-3.

Von Höhnelt, Fragmente zur Mykologie, no. 87, pp. 32-3, May, 1906.

Traverso, Flor. Ital. Cryptog. Part I, Fungi, vol. ii, fasc. 1, October, 1906.

1. ***Phomopsis Achilleae***, v. Höhn. Fragm. zur Mykol. no. 87, p. 32. *Phoma Achilleae*, Sacc. in Mich. ii. 616.

Spores elliptic-fusoid, $8-10 \times 2.5-3 \mu$; sporophores acicular subulate, $20-26 \times 1.1-1.5 \mu$. (Fig. 1.)

On dead stems of *Achillea Millefolium*. Probably the pycnidium of *Diaporthe orthoceras*, Nits. f. *Achilleae*. Undoubtedly British, but the specimens from Kew Gardens, referred to this, are *Diplodina Millefolii*, Allesch., having a true *Phoma*-like pycnidium, obsolete sporophores, spores not in the least degree fusoid and at length faintly 1-septate.

2. ***P. albicans***, Syd. Mycoth. Germ. no. 1012. *Phoma albicans*, Rob. in Ann. Sci. Nat. 1849, xi. 284.

Spores elliptic-fusoid, rather acute at the ends, $8-11 \times 2.2-2.5 \mu$; sporophores subulate, frequently curved, up to $15-16 \times 3 \mu$. (Fig. 2.)

On dead peduncles of various *Compositae*, especially of *Leonodon* and *Hypochoeris*. Stated to be the pycnidium of *Pleospora albicans*, but this is unlikely, since it is a distinct *Phomopsis*; the pycnidia are crowded without order on bleached spots.

3. **Phomopsis ambigua**, Trav. Flor. Ital. Crypt. 1906, Fung. ii. 266. *Phoma ambigua*, Sacc. in Mich. i. 520.

Spores fusoid, often more pointed at one end, $8-10 \times 2.5-3 \mu$; sporophores filiform or subulate, $12-20 \times 1-1.5 \mu$. (Fig. 3.)

On twigs of *Pyrus communis*; possibly also on *P. Malus*. The pycnidium of *Diaporthe ambigua*, Nits.

4. **P. Amelanchieris**, Grove. *Phoma Amelanchieris*, Cooke in Grevill. xiii. 93.

Spores subfusoid, obtuse at apex, $8-9 \times 2-2.5 \mu$; sporophores subulate, curved, $15-20 \mu$ long. (Fig. 4.)

On branches of *Amelanchier*.

5. **P. Arctii**, Trav. l.c. p. 226. *Phoma Arctii*, Sacc. in Mich. ii. 340. Grove, in Journ. Bot. 1916, liv. 187, pl. 542, f. 5.

Spores ellipsoid-lanceolate, rather acute at the ends, $7-9 \times 2.5-3 \mu$; sporophores crowded, more or less subulate, $20-25 \times 1.5 \mu$. (Fig. 5.)

On dead stems of *Arctium Lappa*. Almost certainly the pycnidium of *Diaporthe Arctii*, Nits., with which it is constantly associated. The pycnidial wall is often very imperfect or even non-existent in the upper part. For a long time I could find no B-spores, such as Sydow found, but after examining scores of pycnidia I at length found some of the usual kind, $17-23 \times 0.75-1 \mu$. A very typical *Phomopsis*.

6. **P. Asteriscus**, Grove. *Phoma Asteriscus*, Berk. in Ann. Nat. Hist. 1850, v. 368.

Spores oblong-ellipsoid, scarcely acute at the upper end, $7-8 \times 2-2.5 \mu$; sporophores cylindrical, often arcuate, $12-20 \times 1-1.25 \mu$. (Fig. 6.)

On dead stems of *Heracleum Sphondylium*. Even in his original description (l.c.) Berkeley perceived the characters which mark this species as distinct from the ordinary *Phoma*, and an investigation of the original specimens (Guernsey, Rev. T. Salway) and many others shows that it is distinctly a *Phomopsis*, possibly the pycnidium of *Diaporthe Berkeleyi*, Nits.

7. **P. Aucubae**, Trav. l.c. p. 243. *Phoma Aucubae*, Westd. Exs. no. 1373. *Phoma insularis*, C. & M. in Grevill. xvi. 6 (non Speg.).

Spores ellipsoid or somewhat fusoid, often acute at the ends, $6-9 \times 2-2.5 \mu$; sporophores cylindrical, $10-20 \times 1.5 \mu$.

On dead twigs and leaves of *Aucuba japonica*. The form on the twigs (f. *ramulicola* Sacc. = f. *ramicola* Oud.) is undoubtedly a true *Phomopsis*, the pycnidium of *Diaporthe Aucubae*, Sacc.; and so far as can be seen from several specimens of Westendorp (no. 1373) examined, on the leaves, they are identical with those on the twigs in every respect. Cooke and Massee's specimens of

P. insularis are only *P. Aucubae*, where the ascophorous stage, to which the circumscribing black line belongs, is beginning to be formed. There is no other difference.

8. **Phomopsis Beckhausii**, *Trav. l.c.* p. 270. *Phoma Beckhausii*, Cooke in Grevill. xiii. 91.

Spores sublanceolate, $8-10 \times 2-2.5 \mu$.

On dead branches of *Viburnum Lantana*, in company with young *Diaporthe Beckhausii*, Nits. According to von Höhnelt *P. tineae*, Sacc. is identical with *P. Beckhausii*.

9. **P. Cacti**, *Grove. Phoma Cacti*, Berk. Plants Port. Welw. 1853, p. 12.

Spores oblong-ellipsoid, subacute at the ends, $6-8 \times 1.5-2 \mu$; sporophores cylindrical, crowded, about as long as the spore or twice as long. (Fig. 7.)

On dead stems of *Cactus*. The British specimens examined (Lauderdale House, Highgate) are a true *Phomopsis*; those from Portugal (Crypt. Lusit. no. 72) are the same, but in them were found large numbers of filiform hooked spores, $18-20 \times 0.75 \mu$, in the same pycnidia with the ellipsoid spores—these Berkeley saw and called (l.c.) “filiform sporophores.” The variety *Opuntiae* assigned to this species by Saccardo (Syll. iii. 138) must be something different, being apparently not a *Phomopsis*.

10. **P. Calystegiae**, *Grove Phoma Calystegiae*, Cooke in Grevill. xiii. 94.

Spores sublanceolate, narrowed at each end, $7.5-8 \times 2.5 \mu$.

On dead stems of *Calystegia sepium*. The pycnidium shows the change usual in a *Phomopsis*, from the early imperfect to the later fully-formed state.

11. **P. Caryophylli**, *Grove. Phoma Caryophylli*, Cooke in Grevill. xiii. 94.

Spores fusoid, somewhat obtuse at the ends, $7-9 \times 2.25-2.5 \mu$; sporophores rod-shaped, $12-15 \times 2 \mu$. (Fig. 8.)

On the calyces, peduncles and stems of cultivated *Dianthus*. The dead stems were in parts widely stained with black; evidently the pycnidium of an unknown *Diaporthe*.

12. **P. caulographa**, *Grove. Phoma caulographa*, Dur. et Mont. Flor. Alg., ex Sacc. Syll. iii. 126.

Spores oblong-fusoid, often inequilateral, acute at lower end, $7-8 \times 2-2.5 \mu$; sporophores densely crowded, subulate, $10-12 \times 1.5 \mu$, rising from a very fertile stratum.

On dead stems of *Chaerophyllum temulum*, Warwickshire, Worcestershire! The Yorkshire specimens recorded in the Naturalist (1904, p. 6) do not seem to be the same. I have seen no published authentic specimens, but mine have the black line, suggestive of a *Diaporthe*, very well developed, and the pycnidia aggregated in short linear series on the lanceolate blackish circumscribed spots. But they are not erumpent by a slit, and thus, apart from the spots, this species is different in habit from *P. striaeformis*, var. *hysteriola* (no. 66); the young pycnidial wall is of the usual imperfect character.

13. **Phomopsis Celastrinae**, Grove. *Phoma Celastrinae*, Cooke in Grevill. xiii. 92.

Spores lanceolate, attenuated at each end, $7.8 \times 2.2.5 \mu$; sporophores straight, pointed $12.15 \times 1.5.2 \mu$. (Fig. 9.)

On twigs of *Euonymus americanus*. Certain unattached larger spores, constricted in the middle, about $15 \times 4 \mu$, were seen at the same time, but not on the sporophores. These were perhaps what Cooke meant in giving the size (l.c.) as " $13 \times 5 \mu$ "; they might be immature ascospores of a *Diaporthe*.

14. **P. cinerascens**, Trav. l.c. p. 278. *Phoma cinerascens*, Sacc. in Mich. i. 521. *P. Ficus*, Cast. in Klotzsch, Herb. Mycol. no. 1870. *Libertella ulcerata*, Massee in Gard. Mag. 1898, July 23, p.p.

Spores fusoid, somewhat obtuse at one or both ends, $6.8 \times 2.2.5 \mu$; sporophores filiform-subulate, crowded, straight, faintly coloured below, $16.20 \times 2 \mu$. (Fig. 10.)

On branches of *Ficus Carica*. The pycnidium of *Diaporthe cinerascens*, Sacc. A very typical *Phomopsis*, occurring on the bare wood as well as on the bark. Specimens under the name of *P. Ficus*, Cast. have identical spores and sporophores. Massee's type specimen of *L. ulcerata*, in Herb. Kew, is also the same fungus in the early state, i.e., with incomplete pycnidium, but with the same spores and sporophores, although he ascribes to it spores $55.60 \times 4 \mu$. The length of the sporophores given by Diedicke and Allescher (7.8μ) must be wrong; it is copied from Saccardo, and may be a misprint for 17.18μ .

15. **P. cistina**, Grove. *Phoma cistina*, Cooke in Grevill. xiv. 3.

Spores cylindric-fusoid, obtuse at the ends, $6.8 \times 2.5 \mu$; sporophores cylindrical, about twice as long.

On branches of *Cistus laurifolius*. Accompanied by numerous exoete perithecia, probably those of a *Diaporthe* (§ *Euporthe*), but no asci were seen and only a few 1-septate spores. The pycnidia were those of a *Phomopsis*; the long necks and the circumscribing black line, connected with them by Cooke, belong to the perithecia, which contained no *Phomopsis* spores.

16. **P. coneglanensis**, Trav. l.c. p. 257. *Phoma coneglanensis*, Sacc. in Mich. ii. 240.

Spores oblong-fusoid, $7.8 \times 2.5.3 \mu$; sporophores acicular, about $15 \times 3 \mu$.

On fallen petioles of *Aesculus Hippocastanum*, accompanied by a *Diaporthe* without spores, probably *D. coneglanensis*, S. et S. In Italy and France it is recorded on the twigs also.

17. **P. Corni**, Trav. l.c. p. 268. *Phoma Corni*, Fekl. Symb. Myc. p. 207.

Spores cylindric-oblong or subfusoid, curved, $8.10 \times 2.3 \mu$; sporophores subulate, or oblong and pointed, 10.12μ long. (Fig. 11.)

On twigs of *Cornus alba*, associated with *Diaporthe Corni*, Fekl. It has a typical *Phomopsis* pycnidium. The reference by Cooke and Massee to *Cornus suecica* is a mistake.

18. **Phomopsis cryptica**, v. Höhn. l.c. p. 32. *Phoma cryptica*, Sacc. in Mich. i. 521.

Spores oblong-fusoid, $7-8 \times 2.5-3 \mu$; sporophores subulate, curved, 13-20 by $1-1.5 \mu$.

On branches of *Lonicera*, Cheshire (Ellis)! The pycnidium of *Diaporthe cryptica*, Nits.; imperfect as usual above. The Kent specimens assigned to this species by Cooke are seen on examination to be not on *Lonicera*, but on *Tamus*, and to belong to no. 68.

19. **P. depressa**, Trav. l.c. p. 272. *Phoma depressa*, Sacc. in Mich. ii. 94 (non B. et Br.).

Spores lanceolate-fusoid, $8-10 \times 2.5 \mu$; sporophores filiform, $20-28 \times 1.5 \mu$.

On bark of dead twigs of *Syringa vulgaris*. The pycnidium of *Diaporthe resecans*, Nits. In the specimens examined the pycnidial wall was very imperfect, as in *P. Arctii*.

20. **P. Dipsaci**, Grove. *Phoma Dipsaci*, Cooke in Grevill. xiii. 94.

Spores sublanceolate or fusoid, somewhat obtuse at the ends, $8-9 \times 2.2-5 \mu$; sporophores rod-shaped, crowded, 15-18 by 1.5μ . (Fig. 12.)

On dead stems of *Dipsacus silvestris*. Accompanied by *Pleospora herbarum* and other ascophorous fungi, among which is one that is doubtless the beginning of a *Diaporthe*.

21. **P. Dulcamarae**, Trav. l.c. p. 246. *Phoma Dulcamarae*, Sacc. in Mich. ii. 272.

Spores fusoid, $8-10 \times 2.2-5 \mu$; sporophores subulate, more or less curved, $12-15 \times 2 \mu$.

On dry stems of *Solanum Dulcamara*. The pycnidium of *Diaporthe Dulcamarae*, Nits. Diedicke found in this species both A- and B-spores, the latter filiform, hooked, $25 \times 1-1.5 \mu$.

22. **P. Durandiana**, Died. in Annal. Mycol. 1911, ix. 24. *Phoma Durandiana*, Sacc. et Roum. in Rev. Mycol. 1884, p. 29, pl. 45, f. 37.

Spores oblong-fusoid, sometimes more acute below, $7-9 \times 2-3 \mu$; sporophores rod-like, crowded, about as long or longer.

On dead stems of *Rumex*. Probably the pycnidium of *Diaporthe maculosa*, S. et S. The epidermis is stained black over each spore-mass; just as in *P. Arctii*, there is little of a true pycnidial wall.

23. **P. exul**, Grove. *Phoma exul*, Sacc. in Mich. ii. 95.

Spores fusoid or cylindric-fusoid, subacute at the ends, $7-10 \times 2.2-5 \mu$; sporophores very crowded, subulate, slightly curved, $12-18 \times 2 \mu$.

On twigs of *Maclura aurantiaca*. The pycnidial stage of an unknown *Diaporthe*.

24. **P. fibrosa**, v. Höhn. l.c. p. 33. *Fusicoccum fibrosum*, Sacc. Syll. iii. 247.

Spores ellipsoid, acuminate below, $8-11 \times 5 \mu$; sporophores filiform, $10-16 \times 1.5 \mu$.

On dry branches and trunks of *Rhamnus catharticus*. Saccardo considered this to be the pycnidium of *Diaporthe fibrosa*, Fekl.

25. **Phomopsis glandicola**, Grove. *Phoma glandicola*, Lév. in Ann. Sci. Nat. 1846, v. 281. *Sporonema glandicola*, Desm. sec. Sacc.

Spores oblong-fusoid, $6-7 \times 1.75-2 \mu$; sporophores simple, obclavate, $8-14 \times 2.5 \mu$, arising from a smoke-coloured fertile stratum. (Fig. 13.)

On fallen Acorns. There are two forms of this, occurring together; in one the pycnidia are solitary and the spores as above; in the other the pycnidia are clustered and the spores measure $11-12 \times 2.5-3 \mu$; sporophores nearly the same in both, but inclined to be narrower in the clustered form.

26. **P. Herminierae**, Grove. *Phoma Herminierae*, Cooke in Grevill. xiii. 93.

Spores lanceolate, somewhat rounded above, acute below, $7-8 \times 2 \mu$; sporophores subulate, $12-15$ by 3μ . (Fig. 14.)

On bark of *Herminiera Elaphroxylon*. A typical *Phomopsis*, evidently introduced with the plant from Tropical Africa. With the A-spores were mixed large numbers of flexuous filiform B-spores, $30-40 \times 1 \mu$, on shorter sporophores. Cooke gives the size of the fusoid spores wrongly as $10 \times 3.5 \mu$.

27. **P. incarcerationata**, v. Höhn. l.c. p. 33. *Phoma incarcerationata*, Sacc. in Mich. ii. 95.

Spores fusoid, $8 \times 2 \mu$; sporophores arcuate, $20 \times 1 \mu$.

On dead branches of *Rosa canina*. The pycnidium of *Diaporthe incarcerationata*, Nits.

28. **P. japonica**, Trav. l.c. p. 241. *Phoma japonica*, Sacc. in Mich. i. 521. *Phlyctaena Kerriae*, Karst.

Spores fusoid, $6-10 \times 2.3 \mu$; sporophores filiform, flexuous $15-20 \times 1.5 \mu$.

On twigs of *Kerria japonica*. The pycnidium of *Diaporthe japonica*, Sacc. The black line, mentioned by Saccardo as sometimes bordering the groups of pycnidia, belongs rather to the ascophorous stage; there is no trace of it in the early pycnidial stage.

29. **P. juglandina**, v. Höhn. l.c. p. 32. *Phoma juglandina*, Sacc. in Mich. i. 521.

Spores fusoid, $8-12 \times 2.5-3.5 \mu$; sporophores filiform, curvulous, $15-25 \times 1.1-1.5 \mu$.

On the bark of branches of *Juglans regia*. The pycnidial stage of *Diaporthe juglandina*, Nits. The Kew specimens are rather imperfect, but seem to belong to this species, at least in part. *Phoma Juglandis*, Sacc. Syll. iii. 152, on the nuts, may well be the same species, but no specimens have been seen.

30. **P. Landeghemiae**, v. Höhn. l.c. p. 33. *Phoma Landeghemiae*, Sacc. Syll. iii. 71.

Spores subfusoid, nearly always straight, $5-8 \times 2-2.5 \mu$; sporophores densely crowded, rod-shaped, $12-13 \times 1.5 \mu$. (Fig. 15.)

On twigs of *Philadelphus coronarius*. The pycnidium of *Diaporthe Landeghemiae*, Nits.

31. **Phomopsis Lebiseyi**, Died. in Annal. Mycol. 1911, ix, 25, pl. 1, f. 12. *Phoma Lebiseyi*, Sacc. in Mich. i, 257.

Spores ovoid-fusoid, $8-10 \times 3 \mu$; sporophores subulate or filiform, up to half as long again.

On branches of *Negundo aceroides*. The pycnidium of *Diaporthe Lebiseyi*, Niessl. The spores are rather wider in proportion than in most species of the genus; the pycnidia are flat and broad, pseudo-locellate within, rather thick and even papillate towards the mouth, which is at length exposed by the rupture of the epidermis.

32. **P. Lirella**, Grove. *Phoma lirella*, Desm. in Ann. Sci. Nat. 1849, xi, 281.

Spores elliptic-fusoid, subacute at the ends, $7-8 \times 2-2.5 \mu$; sporophores crowded, more or less cylindrical, $12-15 \times 1 \mu$.

On dry decorticated stems of *Vinca minor*. Externally exactly resembling a species of *Leptostroma*.

33. **P. Lonicerae**, Grove. *Phoma Lonicerae*, Cooke Fung. Brit. i. 616.

Spores elliptic-fusoid, acute at both ends, $8-9 \times 2.5 \mu$; sporophores subulate, $15 \times 2-2.5 \mu$. (Fig. 16.)

On old stems of *Lonicera*. A most typical *Phomopsis*, but quite distinct from *P. cryptica*, v. Höhn. (no. 18). Filiform hooked spores of the usual kind, $25-30 \mu$ long, were found in situ in some of the pycnidia, in company with the A-spores but on shorter sporophores. The wood is frequently stained black round the base of the pycnidia, which leave a whitish pit when they fall away.

34. **P. Lysimachiae**, Grove. *Phoma Lysimachiae*, Cooke in Grevill. xiii. 94.

Spores broadly lanceolate, $7-9 \times 2.5-3 \mu$; sporophores linear, straight, a little longer than the spore.

On stems of *Lysimachia vulgaris*. Presumably the pycnidium of a *Diaporthe*, as it has the true *Phomopsis* characters.

35. **P. Malvacearum**, Grove. *Phoma Malvacearum*, Westd. exs. no. 1232. *P. Lavaterae*, Westd. Not. vi. 22.

Spores elliptic-fusoid, somewhat obtuse at the ends, $7-10 \times 2-3 \mu$; sporophores filiform, densely crowded, $15-18 \times 1.5 \mu$.

On stems of *Malva moschata*. On the Continent, it is recorded on Hollyhock and *Malva silvestris*, and other species of Malvaceae: it may not be different from *P. Ophites*, Trav. (see no. 81). I have not seen the British specimens; the description given above is derived from those published in Westd. exs. no. 1232. Saccardo (and of course Allescher) says "contents brownish," but this is not true of the spores, even in mass, only of the lower proliferous stratum. The pycnidium is as imperfect as that of *P. Arctii*. This species is not, as Allescher asserts, identical with *Phoma nebulosa*, Berk.

36. **Phomopsis Menispermii**, Grove. *Phoma Menispermii*, Peck in 24th Rep. State Mus. New York, 1872, p. 85. *P. sarmenticia*, Sacc. in Mich. ii. 94, 1880.

Spores oblong-fusoid, subacute at the ends, $7-10 \times 2-2.25 \mu$; sporophores subulate, crowded, $20-25 \times 1-1.5 \mu$. (Fig. 17.)

On dead branches of *Menispermum canadense*. The pycnidium no doubt, of an unknown *Diaporthe*. A comparison of the British specimens, which are a true *Phomopsis*, with those of *Phoma Menispermii* from Portugal (Roumeguère, 4461) makes it as certain as one can be, without seeing Peck's original specimens, that *P. sarmenticia*, Sacc. is the same as *P. Menispermii*, Peck. The agreement with Peck's short description is exact; his statement that the pycnidia, on falling out, leave little white pits is just what takes place and what one might expect with a *Phomopsis* where the pycnidium is deeply seated and is less perfectly formed below. A little area of the epidermis over each pycnidium is discoloured; the sporophores are unusually long even for a *Phomopsis*, reaching sometimes to 35μ . The statement by Cooke, that the same species occurs on *Cocculus carolinianus*, cannot be confirmed.

37. **P. moricola**, Grove. *Phoma moricola*, Sacc. in Mich. i. 525.

Spores oblong-ellipsoid, slightly tapering below, somewhat curved, $8-9 \times 2-2.5 \mu$; sporophores cylindrical, crowded, curvulose, $10-12 \times 1.5 \mu$. (Fig. 18.)

On dead twigs of *Morus*. Possibly the pycnidial stage of *Diaporthe Mori*, Berl. The pycnidium is that of a typical *Phomopsis*; it is sometimes accompanied by *Diplodia Mori*, Westd.

38. **P. Mulleri**, Grove. *Phoma Mulleri*, Cooke in Grevill. viii. 8.

Spores narrowly ellipsoid, subacute at the ends, often curved, $8-10 \times 2-2.5 \mu$; sporophores acicular, crowded, curvulose, $15 \times 1 \mu$.

On branches of *Rubus fruticosus*, *R. idaeus*. This species should be compared with *Phomopsis insignis* Trav. l.c. p. 246, which is the pycnidium of *Diaporthe insignis*, Fekl. I have found pycnidia of exactly the same character intimately mingled among perithecia of *Sphaerulina intermixta*, Sacc., which is the same as *S. abbreviata*, Cooke; so far as close association goes, it was just as likely that they should be the early stage of the *Sphaerulina*, as that *Hendersonia Rubi* should be so.

39. **P. nitidula**, Grove. *Phoma nitidula*, Sacc. in Mich. ii. 96.

Spores broadly fusoid, subacute at the ends, $7-8 \times 2 \mu$ ($10-11 \times 2-2.5 \mu$, Sacc.); sporophores filiform, about $15 \times 1.5 \mu$.

On stems of *Scrophularia nodosa*. The pycnidium of an unknown *Diaporthe* (?*D. Tulasnei*); see no. 76.

40. **P. occulta**, Trav. l.c. p. 221. *Phoma occulta*, Sacc. Syll. iii. 150.

Spores narrow-oblong or somewhat obovoid, acute at base, curved in profile view, $9-11 \times 2.2-5 \mu$ ($7 \times 3 \mu$, Sacc.); sporophores crowded, filiform, usually straight, about $15 \times 1 \mu$.

On scales of cones of *Picea excelsa*, Malvern and Dolgelley (Ellis)! The pycnidium of *Diaporthe occulta*, Nits., which has previously been recorded as British. The spores resemble much those of *Cytospora stictostoma*, Grove, but are longer and there is no cytosporoid stroma (as in that species), though the part of the scale where the pycnidia occur tends to be stained with black. The pycnidium is imperfect above.

41. **Phomopsis petiolorum**, Grove. (?) *Phoma petiolorum*, Desm. in Ann. Sci. Nat. 1847, viii. 16.

Spores fusoid-oblong, more acute below, $7-8 \times 2.2-5 \mu$; sporophores subulate, inflated below, $12-15 \times 2.5-3 \mu$. (Fig. 19.)

On fallen petioles of *Robinia Pseudacacia*; recorded also on petioles of *Cytisus* and *Gleditschia*, in other countries. Saccardo gives the sporophores as "filiform, $20-23 \times 1 \mu$," but these probably represent B-spores. There seems no reason why this form on *Robinia* should not be considered identical with *Phomopsis Pseudacaciae*, Trav., which is found on the branches of *Robinia*, and is the pycnidium of *Diaporthe fasciculata*, Nits. The form on *Sophora*, sometimes included here, belongs to *P. Sophorae* (see no. 63). Probably all these "species" on petioles are merely forms of those on the branches of the same plant: see nos. 16 and 69. *Phoma petiolorum*, Fekl. (Symb. Myc. p. 132) is quite different, and appears to be the pycnidium of a *Pleospora*; I have found both the *Phoma* and the *Phomopsis* on *Robinia* petioles, the former with a *Pleospora* akin to *P. herbarum*.

42. **P. Phaseoli**, Grove. *Phoma Phaseoli*, Desm. in Ann. Sci. Nat. 1836, vi. 247.

Spores elliptic-oblong or subelavate-fusoid, rather acute at the ends, $7-9 \times 2.5-3 \mu$; sporophores cylindric-subulate, about $15 \times 2.2-5 \mu$. (Fig. 20.)

On old stems of *Phaseolus*. No doubt the pycnidium of a *Diaporthe*, possibly *D. Phaseolorum*, C. et E. The specimens of Desmazières (Pl. Crypt. no. 843) seem to be the same as the British ones, but younger; the pycnidium is often imperfect and they are in any case a *Phomopsis*, but the f. *Lepidii*, Sacc. is different.

43. **P. piceata**, Grove. *Phoma piceata*, Sacc. Syll. iii. 107. *Phoma picea*, B. et Br. in Ann. Nat. Hist. 1850, v. 370 (non Pers.).

Spores oblong-ellipsoid, subacute at the ends, straight or faintly curved, often irregular, $7-9 \times 2.2-5 \mu$; sporophores linear, straight, $15-18 \times 2 \mu$. (Fig. 21.)

On the under surface of dead Rose leaves. This is a doubtful species; the measurements have been taken from Berkeley's original specimens. The spores were often seen constricted as if about to become 1-septate, but they never became so. *Phoma*

picea (Pers.) Sacc. is also a *Phomopsis* (*Phomopsis picea*, v. Höhn.), though not British; therefore Berkeley's specific name cannot stand. The resemblance of *P. piceata* to *Ceuthospora concava*, Desm. (Ann. Sci. Nat. 1847, vii. 17) is very close, but the latter is much broader (about $2\frac{1}{2}$ times) and has different spores; nevertheless it is impossible not to suspect that they are mere forms of each other.

44. **Phomopsis Platanoidis**, Died. Krypt. Brand. Pilz. p. 242. *Phoma Platanoidis*, Cooke in Grevill. xii. 93.

Spores fusoid, rather acute at the ends, $7-8 \times 2-2.5 \mu$; sporophores filiform, longer than the spore.

On twigs of *Acer Pseudoplatanus*. Cooke says that it was associated with *Calospora Platanoidis*, Niessl, and suggests that it is the pycnidium of that species, but analogy would make it rather to belong to a *Diaporthe*. The British specimens seem to incline somewhat towards *Fusicoccum*.

45. **P. Podophylli**, Grove. *Phoma Podophylli*, Cooke in Grevill. xv. 108.

Spores elliptic-fusoid, frequently biguttulate, $7-10 \times 2.5-3 \mu$; sporophores rod-like, straight, $15-20 \times 2 \mu$. (Fig. 22.)

On fading leaves of *Podophyllum*. No doubt the pycnidial stage of an unknown *Diaporthe*. Just as in *P. Arctii*, there is no true complete pycnidium. Other species of *Phomopsis* are known upon leaves (see nos. 7, 43, 65, 74), but such a habitat is rare.

46. **P. Polygonorum**, Grove. *Phoma Polygonorum*, Cooke in Grevill. xiv. 3.

Spores ellipsoid, somewhat obtuse at the ends, $6-7 \times 2.5 \mu$; sporophores acicular, $10 \times 2 \mu$.

On dry stems of *Polygonum cuspidatum*. Probably the pycnidium of an unknown *Diaporthe*. Cooke wrongly gives the size of the spores as $12 \times 3 \mu$.

47. **P. Prunorum**, Grove. *Phoma Prunorum*, Cooke in Grevill. xiii. 92. *Phoma Pruni-lusitanicae*, Cooke l.c. p. 93. *P. Pruni*, Peck in 38 Rep. State Mus. p. 95.

Spores fusoid, subacute at the ends, $8-9 \times 2-2.5 \mu$; sporophores cylindrical, $12-15 \times 2 \mu$.

On twigs of *Prunus Laurocerasus*, *P. lusitanica*. Possibly the pycnidium of *Diaporthe viridarii*, Sacc. Some authorities give the spores a greater width (Cooke, 4.5μ ; J. W. Ellis, $3-4 \mu$), but I find them as stated. When the twigs of *P. lusitanica* are dry, the epidermis around the pycnidia retains its colour, but there is no difference otherwise between Cooke's two species.

48. **P. pterophila**, Died. Krypt. Brand. Pilz. p. 255. *Sphaeria pterophila*, Nits, in litt. ad Fckl. *Phoma pterophila*, Fckl. Symb. Myc. p. 377.

Spores ellipsoid, subacute at the ends, $7-8 \times 2.5 \mu$; sporophores subulate or filiform, curved or straight, $11-13 \times 1-1.5 \mu$. (Fig. 23.)

On samarae of *Fraxinus excelsior*, but only on the thick part enclosing the seed, not on the wing. The pycnidium of *Diaporthe samaricola*, Phill. et Plow. At once distinguished from *Phoma samararum*, on the same habitat, by its larger size and the faint brown halo surrounding each pycnidium; the latter, moreover, occurs chiefly on the wing.

49. *Phomopsis pulla*, Trav. l.c. p. 244. *Phoma pulla*, Sacc. in Mich. ii. 96.

Spores oblong or ellipsoid, $7-8 \times 2-3 \mu$; sporophores curved, $12-16 \times 1 \mu$.

On dead branches of *Hedera Helix*. Often accompanied by *Diaporthe pulla*, Nits. of which it is undoubtedly the pycnidium. It is sometimes also found in company with *Diplodia Hederae*, Fekl.

50. *P. pustulata*, Died. in Annal. Mycol. 1911, ix. 28. *Phoma pustulata*, Sacc. Syll. ii. 91.

"Spores oblong, $10-13 \times 3-5 \mu$; sporophores filiform, curved, 14μ long."

On dead branches of *Acer palmatum*. The pycnidium of *Diaporthe pustulata*, Sacc. No specimens seen.

51. *P. quercella*, Died. ibid. *Phoma quercella*, Sacc. Syll. iii. 96.

Spores fusoid, acute at the ends, $8-12 \times 2-3 \mu$; sporophores rod-shaped, $12-15 \times 2 \mu$, arising from a yellowish fertile stratum. (Fig. 24.)

On twigs of *Quercus*. Presumably the pycnidium of an unknown *Diaporthe*.

52. *P. quercina*, v. Höhn. l.c. p. 33. *Fusicoccum quercinum*, Sacc. in Mich. ii. 345.

Spores cylindric-fusoid, gently curved, $7-10 \times 1.5-2 \mu$; sporophores filiform, a little shorter than the spore.

On branches of *Quercus*, Malvern (Ellis). Considered to be the pycnidium of *Diaporthe leiphaemia*, Sacc. (*Valsa leiphaemia*, Fr.). These British specimens are almost intermediate between *Fusicoccum* and *Phomopsis*. But there seems to exist also a form with larger spores ($15-16 \times 3-3.5 \mu$), and also of an intermediate size ($10-14 \times 3-3.5 \mu$), all otherwise very similar and representing a true *Fusicoccum*. The material available is not sufficient to decide the question, but the Malvern specimens are evidently the same as those which Fuckel assigned (*Symb. Myc.* p. 194) to his *Cryptospora leiphaemia*. No specimens from the other recorded British localities have been seen.

53. *P. Radula*, Grove. *Phoma Radula*, B. et Br. in Ann. Nat. Hist. 1850, v. 369.

Spores elliptic-fusoid, subacute at the ends, $9-10 \times 2-3 \mu$; sporophores acicular, $15-20 \times 2 \mu$. (Fig. 25.)

On dead twigs of *Platanus*. A true *Phomopsis*.

54. **Phomopsis Rhois**, Trav. l.c. p. 258. *Phoma Rhois*, Sacc. in Mich. ii. 340.

Spores elliptic-fusoid or oblong-fusoid, rather obtuse at the upper end, $7-10 \times 2-2.25 \mu$; sporophores subulate, $12-15 \times 1.5-2 \mu$.

On dead branches and peduncles of *Rhus typhina*, *R. radicans*. The pycnidium of *Diaporthe Rhois*, Nits. which sometimes accompanies it.

55. **P. Robergeana**, Died. in Annal. Mycol. 1911. ix. 29. *Phoma Robergeana*, Sacc. in Mich. i. 520.

Spores fusoid or lanceolate, straight or somewhat curved, $9-14 \times 2-2.5 \mu$; sporophores filiform, $25-30 \times 1.5 \mu$.

On twigs of *Staphylea pinnata*. Probably the pycnidium of *Diaporthe Robergeana*, Niessl.

56. **P. Rosae**, Grove. *Phoma Rosae*, Schulz, et Sacc. Micr. Slav. no. 46.

Spores narrowly ellipsoid, rather obtuse at the ends, straight, $7.8 \times 2.5 \mu$; sporophores rod-shaped, $15-20 \times 2 \mu$.

On prickles of *Rosa canina*. The pycnidium of an unknown *Diaporthe*; the pycnidial wall is formed below in the typical way. Cf. no. 27.

57. **P. rudis**, v. Höhn. l.c. p. 32. *Phoma rudis*, Sacc. in Mich. i. 257.

Spores elliptic-fusoid, subacute at the ends, $7-9 \times 2 \mu$; sporophores densely crowded, filiform, straight, $20-24 \times 1-1.5 \mu$.

On twigs of Laburnum. The pycnidium of *Diaporthe rudis*, Nits. The pycnidia are not depressed, but somewhat conical, and raise the epidermis considerably before bursting it open. Saccardo suggests that it afterwards develops into his *Rabenhorstia rudis*; this may be so, but the spores of the latter are oblong and blunt at the ends.

58. **P. Ryckholtii**, v. Höhn. l.c. p. 33. *Phoma Ryckholtii*, Sacc. Syll. iii. 70.

Spores obtusely fusoid, $5-9 \times 2.5-3 \mu$; sporophores rather long.

On branches of *Symphoricarpus racemosus*. The pycnidium of *Diaporthe Ryckholtii*, Nits. There can be no doubt whatever that *Phlyctaena phomatella*, Sacc. var. *Symphoricarpi-racemosae* is the same species with the B-spores, while the form recorded above shows the A-spores.

59. **P. salicina**, Died. in Annal. Mycol. 1911, ix. 30. *Phoma salicina*, Westd. ex Sacc. Syll. iii. 97.

Spores ellipsoid-oblong, somewhat obtuse at the ends, $6-7 \times 2-2.5 \mu$; sporophores densely crowded, about as long.

On branches of *Salix babylonica*, *S. viminalis*, and other species. This has been supposed to be the pycnidial stage of a *Diaporthe*, but the British and foreign specimens under this name examined do not seem to be in agreement with this supposition.

60. **Phomopsis sambucina**, Trav. l.c. p. 269. *Phoma sambucina*, Sacc. in Mich. ii. 97.

Spores oblong-fusoid, subacute at the ends, $5-9 \times 2.5-3 \mu$; sporophores acicular, $15-20 \times 1.5-2 \mu$. (Fig. 26.)

On twigs of *Sambucus nigra*. The pycnidium of *Diaporthe circumscripta*, Otth.

61. **P. Sarothamni**, v. Höhn. l.c. p. 33. *Phoma Sarothamni*, Sacc. Syll. iii. 68. *P. Spartii*, Sacc. in Mich. i. 359.

Spores fusoid-oblong, acute at one end, $8-12 \times 2.2-5 \mu$; sporophores filiform, more or less curved, $15-20 \times 1.1-5 \mu$.

On dry branches of *Sarothamnus scoparius*. The pycnidium of *Diaporthe Sarothamni*, Nits. When fully formed this is very conspicuous. *P. Spartii*, Sacc. agrees exactly with the British specimens on Broom.

62. **P. scobina**, v. Höhn. l.c. p. 33. *Phoma scobina*, Cooke in Grevill. xiii. 92. *Myxolibertella scobina*, v. Höhn. in Annal. Mycol. i. 526.

Spores elliptic-fusoid, sometimes subclavate, $7-10 \times 2.2-5 \mu$; sporophores subulate or cylindrical, occasionally curved or bent, $10-12 \times 1.5 \mu$; B-spores about $20 \times 1 \mu$. (Fig. 27.)

On twigs of *Fraxinus excelsior*. Frequently accompanied by *Diaporthe scobina*, Nits. of which it is the pycnidium. It is recorded in Yorkshire Fungus Flora on leaves of Ash, possibly in error.

63. **P. Sophorae**, Trav. l.c. p. 260. *Phoma Sophorae*, Sacc. Syll. iii. 67.

Spores oblong-fusoid, sometimes curved, often somewhat clavulate, $8-11 \times 2.2-5 \mu$; sporophores cylindrical, rather obtuse, $15-20 \times 2 \mu$.

On dead twigs of *Sophora japonica*. The pycnidium of *Diaporthe Sophorae*, Sacc. The pycnidia are sometimes arranged in little groups, surrounded by a narrow black line (significant of a *Diaporthe*), but this is frequently not present. The width of the spores is given by Saccardo as $3.5-4 \mu$, and the sporophores are said to be hooked, $25 \times 0.5 \mu$; these latter are no doubt the B-spores which Diedicke found in the larger pycnidia, but of which no trace was seen in the British specimens or in the many foreign ones examined. Saccardo issued (Mycothec. Venet. 1547) a remarkable form of this species (var. *libricola*, Sacc.), which has the pycnidia arranged in lines, immersed in the bark of the trunk, and each surrounded by a black stain. The spores and sporophores, however, are as described above.

64. **P. Sorbariae**, v. Höhn. l.c. p. 32. *Phoma Sorbariae*, Sacc. Syll. iii. 75.

Spores oblong-fusoid, often rather blunt at the ends, $7-9 \times 2.5 \mu$; sporophores cylindrical, a little longer than the spore or twice as long. Mixed with these in the same pycnidia were found occasionally B-spores, filiform, hooked, $20-25 \times 1 \mu$. (Fig. 28.)

On dead branches of *Neillia opulifolia* and (?) *Spiraea japonica* (= *callosa*). The pycnidium of *Diaporthe Sorbariae*, Nits. In

some of the pycnidia there were large numbers of the filiform spores, which were seen both in situ (parallel, crowded, and intermixed with the A-spores) and loose among the spore-mass. They were of various shapes, flexuous, curved, arcuate, and hooked, but always filiform; their sporophores were but little different from those of the A-spores. This species may be considered the most typical *Phomopsis* of all those examined.

65. ***Phomopsis stictica***, Trav. l.c. p. 276. *Phoma stictica*, B. et Br. in Ann. Nat. Hist. 1850, v. 370.

Spores fusiform-ellipsoid, acute at the ends, $7.8 \times 2.5\text{--}3.5 \mu$; sporophores cylindrical, $10 \times 1.5 \mu$.

On dead leaves, twigs, and branches of *Buxus sempervirens*. The pycnidium of *Diaporthe retecta*, Nits. The spores are broader than usual, and shaped like a "tip-cat"; those on the leaves are exactly the same as on the twigs.

66. ***P. striaeformis***, Grove. *Phoma striaeformis*, Dur. et Mont. Fl. Alger. p. 603.

Spores elliptic-fusoid, slightly clavate at times, $7.9 \times 2.2\text{--}5 \mu$; sporophores rod-shaped often curved, $15\text{--}18 \times 2 \mu$. (Fig. 29.)

On twigs of *Kerria japonica*. It is recorded from the Continent also on *Cytisus* and *Sambucus*, but this is doubtful. This species forms short linear black flecks, arranged longitudinally on the stem, about 1 mm. long on the average, but also shorter or longer in some cases. The statement in the description that the sporophores are "very short" is not in accordance with the specimens issued by Desmazières (ser. ii. no. 59), in which they are as described above.

var. ***hysteriola***, Sacc. in Mich. ii. 93. Grove, in Journ. Bot. 1916, liv. 188. *Phoma hysteriola*, Allesch. vi. 288.

Spores oblong-lanceolate, tapering downwards or even acute at the base, $6.9 \times 2.25\text{--}3 \mu$; sporophores densely crowded, simple, subulate, as long as or longer than the spores, springing from a thick olive-brown stratum.

On the swollen part of dead stems of *Chaerophyllum temulum*, Cheshire (Ellis)! An evident *Phomopsis*, distinguished from the type by the pycnidia being erumpent in an *Hysterium*-like manner between the fibres of the stem. Saccardo described the spores as 4-guttulate; such spores were seen and a few were 3-guttulate, but the majority of the mature spores were always distinctly 2-guttulate. Allescher (who had not seen it or the type) made this variety a separate species on the ground of the longer sporophores; but this distinction falls to the ground when it is seen that the sporophores of the type can be much longer than the spores.

67. ***P. subordinaria***, Trav. l.c. p. 232. *Phoma subordinaria*, Desm. in Ann. Sci. Nat. 1849, xi. 284. *Phlyctaena Plantaginis*, Lamb. et Fautr.

Spores oblong-fusoid, rather blunt at the ends, often curvuluous, sometimes subclavate, $7\text{--}10 \times 2.2\text{--}5 \mu$; sporophores rather short, up to $12 \times 1.5 \mu$.

On dead scapes of *Plantago lanceolata*. The pycnidium of *Diaporthe adunca*, Niessl. There is at first no true pycnidium, merely the discoloured epidermis, but later there arises round the pore a thick smoky-brown sclerotial tissue, which at length falls out in the way previously described. On the Continent this species is recorded also on *P. major* and *P. media*. According to Diedicke it is a parasite, appearing as early as July, and often causing a sharp bend of the upper part of the attacked scapes, by which they are easily recognisable. These statements are not known to be true of the British specimens. The inclining of the spike is owing to the fact that the attack begins at the upper part of the green peduncle, which then leans over through the weakening of the support; afterwards the attack proceeds downwards. A true *Phoma* can, at times, also be found on the same peduncles.

68. **Phomopsis tamicola**, Trav. l.c. p. 233. *Phoma tamicola*, Cooke in Grevill. xiii. 95. *Phlyctaena vagabunda*, Desm. in Ann. Sci. Nat. 1847, viii. 16, var. *Tami*.

Spores fusoid, rather obtuse at the ends, $8\text{--}9 \times 2\text{--}2\cdot5\text{--}3 \mu$; sporophores linear-subulate, crowded, $15 \times 1\text{--}1\cdot5 \mu$; B-spores $20\text{--}25 \times 1 \mu$.

On dry stems of *Tamus communis*. The pycnidium of *Diaporthe scandens*, Sacc. et Speg. There cannot be the slightest doubt that the *Phlyctaena* on *Tamus* is merely the earlier state of the *Phomopsis*, before the pycnidial wall is fully developed and when the filiform spores alone are being produced. Attempts, however, to find both forms of spore in the same pycnidium were unsuccessful.

The non-British *Phlyctaena vagabunda*, var. *Phytolaccae* is similarly the early state of *Phomopsis Phytolaccae*, Grove (*Phoma Phytolaccae*, B. et C.), which is a true *Phomopsis*. This early state is found in close company with the mature state, and is what is called by Saccardo (Syll. iii. 594) *Phlyctaena septorioides*, Sacc.

69. **P. velata**, v. Höhn. l.c. p. 33. *Phoma velata*, Sacc. in Mich. ii. 96.

f. *minor*, Sacc. Syll. iii. 92 = *P. communis*, Rob. in Herb. Desm. ser. ii. no. 693.

Spores oblong-fusoid, blunt at the ends $7\text{--}8 \times 2\text{--}2\cdot5 \mu$; sporophores cylindrical, up to $14 \times 1\cdot5 \mu$. (Fig. 30.)

On bark of *Tilia* spp. The pycnidium of *Diaporthe velata*, Nits. The typical form has longer spores ($10\text{--}12 \mu$) and sporophores (20μ). *Phoma communis*, Rob. seems to be a still smaller form on the twigs and petioles.

In the British specimens there were found, in similar (but not, so far as was seen, the same) pycnidia, large numbers of B-spores, filiform, flexuose or hooked, $16\text{--}20 \times 1 \mu$, borne on short papilliform cells such as Diedicke describes and figures for *Phomopsis oblita*, Sacc. (Annal. Mycol. 1911 ix. 26, pl. 3, f. 4). In Desmaz. 693 the B-spores were found in abundance; in typical *P. velata*, Diedicke found only the A-spores.

70. **Phomopsis viridarii**, Grove. *Phoma viridarii*, Sacc. in Mich. ii. 96.

Spores more or less fusoid, straight or curvuluous, $8-10 \times 2.25-3 \mu$; sporophores cylindrical, $8-11 \times 1.5 \mu$.

On twigs of *Magnolia grandiflora*. No doubt the pycnidium of a *Diaporthe*, since it is a *Phomopsis*, but with sporophores hardly longer than the spores.

71. **P. viticola**, Grove. *Phoma viticola*, Sacc. in Mich. ii. 92. *Phoma viniferae*, Cooke in Grevill. xiii. 92 (1885). (Non *Phoma viticola*, Sacc. Syll. iii. 110 = *P. vitea*, Sacc. l.c. 860 = *Sphaeropsis viticola*, Cooke in Grevill. xii. 22, quae *Macrophoma*.)

Spores elliptic-fusoid, subacute at the ends, usually straight, $7-10 \times 2.2-2.5 \mu$; sporophores subulate, $10-12 \times 2.5 \mu$.

On dead branches of *Vitis vinifera*. Possibly the pycnidium of *Diaporthe viticola*, Nits. *Phoma cordifolia*, Brun. Champ. Saint. vii. 4 (Sacc. Syll. x. 152) does not seem to differ from this *Phomopsis*, which may be found on the same rods with *Phoma Vitis*, Bon.

SPECIES NOVAE.

72. **Phomopsis Aristolochiae**, Grove, sp. n.

Pycnidia dense sparsa vel gregaria, oblonga vel rotundata, convexa, immersa, dein prominula, primo tantum ostiolo erumpentia, 0.25-0.3 mm. longa, nigrescentia. *Sporulae* elliptico-fuseidaeae, inaequilaterales vel subcurvatae, utrinque praecipue basi acutatae, biguttulatae, $9-10 \times 2.25-2.75 \mu$; sporophorae bacillares vel subulatae, stipatae, plerumque rectae, circa $12-15 \times 1-1.5 \mu$.

Hab. in caulibus emortuis *Aristolochiae Siphonis*, in Hort. Bot. Kew, Maio.

The pycnidium is here also very imperfect. At first it is entirely hidden beneath the epidermis, then it becomes erumpent by what looks like a minute black point (ostiolo), the rest showing through the translucent epidermis as a convex blackish mass surrounding the black point; afterwards the whole of the upper part disappears and a wide-mouthed blackish-brown hollow full of spores is left. At this stage the fungus looks very like a *Gloeosporium*, such as *G. nervisequum*, but of course the spores and sporophores are very different. The many-layered mass of cells from which the sporophores originate ("proliferous stratum") is tinged as usual with pale olivaceous.

73. **Phomopsis aucubicola**, Grove. *Phoma lirelliformis*, Sacc. var. *aucubicola*, Brun. in Act. Soc. Linn. Bord. 1888, p. 15, extr. (?) Grove, in Journ. Bot. 1916, liv. 187, pl. 542, f. 4.

Pycnidia dense gregaria, nigra, innato-erumpentia, dimorpha, alia rotundata v. oblonga, pustuliformia, prominula, 0.5 mm. diametro, alia plus minusve transverse elongata, etiam lirelliformia, usque 3 mm. longa, circa 0.16 mm. lata, contextu *Phomopsisidis*. *Sporulae* dimorphae, aliae ovoideo-oblongae vel subfusoidae, saepe biguttulatae, $7-12 \times 2.5 \mu$, sporophoris subu-

latis, $9-15 \times 2 \mu$, interdum longioribus suffultae, aliae filiformes, curvatae vel uncinatae, $20-30 \times 0.75-1 \mu$, sporophoris similibus. (Fig. 31.)

Hab. in ramulis emortuis *Aucubae japonicae*, in Hort. Bot. Birmingham, Martio.

The two kinds of spores occurred often in the same pycnidium side by side, the B-spores as abundant sometimes as the others. The sporophores which had lost their spores frequently became elongated and acuminate so as to resemble at first sight the B-spores, but retained always the subulate base. The foregoing account, owing to examination of fresh specimens, differs slightly from that given in Journ. Bot. l.c.; whether the species is identical with Brunaud's variety is doubtful, but it is quite different from *P. Aucubae*, Trav. (no. 7).

It seems likely that this fungus is a parasite. In the Botanic Gardens a number of Aucubas have gradually died at intervals, beginning at the ends of some of the branches, and on the dead twigs the *Phomopsis* has been found; imperfect pycnidia occur on the living and still green branches, though no spores were found in them. The appearances suggest that the fungus having entered (how is not known), the mycelium gradually destroys the bast, cambium, medullary rays and pith; finally the cortex is destroyed, leaving the epidermis loosened; the spores are then produced on the dead twigs. It should be noted that *Phomopsis subordinaria* (no. 67) on *Plantago* and *P. Stewartii*, Peck on *Cosmos*, are also regarded as parasitic.

74. **Phomopsis Bloxami**, Grove. *Phoma Bloxami*, Berk. in Herb. Kew. *Vermicularia Eryngii*, Cooke in Grevill. (non Eckl.)

Pycnidia dense congregata, innata, glabra, $0.16-0.3$ mm. diametro, nigra, epidermide circum circa nigrificata ostiolo minuto pertusa; contextu tenui parenchymatico fuligineo. *Sporulae* elliptico-fusoideae, ut plurimum utrinque acutatae, raro curvulae, plerumque eguttulatae, $10-12 \times 1.5-2 \mu$ (rarius 2.5μ lat.)

Hab. in stipitibus foliisque *Eryngii maritimi*, Fleetwood, A. Bloxam; Scotland, Greville, Julio.

The smooth black patches by which the pycnidia are surrounded are very conspicuous.

75. **Phomopsis Cruciferae**, Grove, sp. n.

Pycnidia sparsa, lineari-lanceolata, parallele secus fibras stipitis disposita, epidermide tecta, dein rima erumpentia, usque 1 mm. longa, nigra. *Sporulae* oblongo-fusoideae, utrinque obtusiusculae, $7-8 \times 2.5 \mu$; sporophorae cylindricae, rectae, $10-12 \times 1.5 \mu$.

Hab. in stipitibus emortuis *Cruciferae* cujusdam, in Hort. Bot. Kew. Aprili.

76. **Phomopsis Solani**, Grove. *Phlyctaena maculans*, Fautr. in Rev. Mycol. 1896, p. 70.

Pycnidia densiuscule sparsa, nec in maculas discretas congregata, primo epidermide velata, ad 0.25 mm. diametro, globoso-depressa vel oblonga, nigra, ostiolo erumpente, halone nigrescente

cincto. *Sporulae* elliptico-fusoideae, utrinque vel saltem basi acutatae, biguttulatae, $7.8 \times 2.5-3 \mu$; sporophorae cylindrico-subulatae, apice acutae, $10-15 \times 1.1-1.5 \mu$; B-sporulae (in iisdem vel discretis pycnidiiis) filiformes, curvatae vel uncinatae, $20-25 \times 0.75-1 \mu$, sporophoris brevioribus ($5-8 \mu$ long.) subdigitaliformibus suffultae.

Hab. in stipitibus emortuis *Solani tuberosi*, Botley, Hants, A. D. Cotton, Jan.

The pycnidia are at first imperfect in the usual way, at length erumpent and pierced at the summit by a pore. In this species the subhymenial tissue is more fuliginous and softer (cell-walls less clearly marked) than in most other species; in the *Phlyctaena-state* exactly the same peculiarity is notable. In the imperfect state some of the pseudo-pycnidia had only A-spores, some only B-spores; in relatively few cases both kinds of spores were found in the same pycnidium.

P. Solani presents certain similarities to the description of *P. Tulasnei*, Sacc. (Annal. Mycol. i. 27), but shows also considerable differences, which entitle it for the present to be treated as distinct, until it shall be demonstrated that they are both pycnidia of *Diaporthe Tulasnei*, Nits. *Phlyctaena maculans* is described by Fautrey as having spores 35μ long, on sporophores about 12μ long, but there can be little doubt that it is identical with this species.

It should be noted that *P. nitidula* (no. 39) and *P. Aristolochiae* (no. 72) bear great similarity in certain aspects to *P. Solani*, and are also under suspicion of being possibly mere pycnidial stages of *D. Tulasnei*, but in the present state of knowledge it would be premature to unite all these under one name.

SPECIES EXCLUDED FOR THE PRESENT FROM THE BRITISH LIST.

77. **Phomopsis Coluteae**, Died. in Annal. Mycol. 1911, ix.
22. *Phoma Coluteae*, Sacc. et Roum. in Mich. ii. 338.

Spores oblong-fusoid, $7-9 \times 2.5-3 \mu$; sporophores oblong-lanceolate, faintly coloured, about as long as the spore.

"On branches of *Colutea arborescens*. Kew Gardens; Dalton." The Kew specimens, which are marked "forma minor, spores $5 \times 3 \mu$, without nuclei," certainly do not belong to this species, but to *Coniothyrium Fuckelii*, which has spores reaching $5 \times 3 \mu$; when young these spores are quite colourless, and may be easily mistaken for a *Phoma*, but never for a *Phomopsis*. The description given above is drawn up from French specimens (*Roumeguère*, 911), which are undoubtedly a *Phomopsis*, though with unusually short sporophores.

78. **Phomopsis Coronillae**, Trav. l.c. p. 240. *Phoma Coronillae*, Westd. Exs. no. 966.

"Spores ovoid-oblong, $7-8 \times 3 \mu$; sporophores filiform, arcuate, $20 \times 1.5 \mu$."

"On dead branches of *Coronilla Emerus* and *Baccharis halimifolia*. Kew Gardens." The pycnidium of *Diaporthe Coronillae*, Sacc. No fungus answering to this description could be found on the Kew specimens, although there were a *Diplodia* and a

Hendersonia, as well as other fungi. The species of Westendorp (no. 966) is a decided *Phomopsis* (Fig. 32), and the spores as usual tend to be plainly fusoid (not ovoid-oblong); the sporophores are acicular and flexuous, rather than arcuate, but of the dimensions given. Saccardo's *Mycoth. Ven.* no. 1210 yielded nothing but *Phlyctaena*-like spores, $15-16 \times 1 \mu$, which are no doubt the B-spores of the same species.

79. ***Phomopsis foveolaris***, Trav. l.c. p. 257. *Sphaeria foveolaris*, Fr. Syst. Myc. ii. 499. *Phoma foveolaris*, Sacc. in Mich. ii. 94.

"Spores ovoid or obovoid, $6 \times 3 \mu$."

"On dead branches of *Euonymus*. Kew Gardens." There is every probability that this may be found in Britain, but the Kew specimens are not a *Phomopsis*. In Continental specimens the spores are seen to be less fusoid and broader in comparison with their length than is usual in that genus. It is considered to be the pycnidium of *Diaporthe Laschii*, Nits.

80. ***Phomopsis morphaea***, Grove. *Phoma morphaea*, Sacc. in Mich. ii. 273.

"On stems and capsules of *Papaver*" *orientale* (not *somniferum*, as stated). "Kew Gardens. Jan."

The species of Saccardo is decidedly a *Phomopsis*, but nothing answering to his description can now be found on the Kew specimens, although there are some other fungi, including a *Diplodina* (*D. morphaea*, sp. n.) which might have been mistaken for it.

81. ***Phomopsis Ophites***, Trav. l.c. p. 254. *Phoma Ophites*, Sacc. Syll. iii. 89.

Spores fusoid, acute at the ends, straight, $8-10 \times 2 \mu$; sporophores acicular, crowded, $15 \times 1.5 \mu$.

"On dead stems of *Hibiscus syriacus*. Kew Gardens." The pycnidium of *Diaporthe Ophites*, Sacc. French specimens agree exactly with the description; the pycnidium is immersed wholly in the wood, and is as incomplete as that of *P. Arctii*. But on the Kew specimens of Cooke there is nothing in the remotest degree resembling these.

82. ***Phomopsis sambucella***, Trav. l.c. p. 244. *Phoma sambucella*, Sacc. Syll. iii. 71.

"On dead branches of *Sambucus nigra*. Kew Gardens." Said to be the pycnidium of *Diaporthe spiculosa*, Nits., but no specimens seen (including those of J. W. Ellis from Cheshire) agreed with the description. The latter are distinctly not a *Phomopsis*.

83. ***Phomopsis sarmentella***, Trav. l.c. p. 277. *Phoma sarmentella*, Sacc. Syll. iii. 140.

"Spores cylindric-fusoid, curvuluous, obtuse, $5-6 \times 2-3 \mu$; sporophores rod-shaped, about twice as long as the spore."

"On Hop vines. Isleworth." Probably the pycnidium of *Diaporthe sarmenticia*, Sacc. On the specimens from this

locality, however, in Herb. Kew, no *Phomopsis* can be found, only *Phoma herbarum*, f. *Humuli*, and two fungi belonging to other genera.

84. **Phomopsis Staphyleae**, Grove. *Phoma Staphyleae*, Cke. in Grevill. xiv. 2.

Spores elliptic-fusoid, often acute at the lower end, $8-10 \times 2.5-3 \mu$; sporophores rod-like, about 10μ long.

On thin twigs of *Staphylea colchica*, *S. pinnata*, *S. trifoliata*. Kew Gardens. These specimens appear to be a *Phomopsis*, though the conclusion is not quite free from doubt. Cooke describes the sporophores as indistinct, but I find them as stated. If it is a *Phomopsis*, it is probably nothing but a smaller form of *P. Robergeana*; see no. 55.

85. **Phomopsis Tecomae**, Grove. *Phoma Tecomae*, Sacc. Syll. iii. 91.

"Spores fusoid, somewhat obtuse at the ends, $8 \times 3 \mu$; sporophores filiform, curvulous, $20 \times 1 \mu$."

"On *Tecoma radicans*. Kew Gardens." On the Kew specimens, there is nothing at all resembling the description of this species, only a large quantity of a *Coniothyrium* which agrees with other specimens of *C. Fuckelii* except that the spores are very pale in colour.

86. **Phomopsis Vepris**, v. Höhn, l.c. p. 33. *Phoma Vepris*, Sacc. Syll. iii. 76.

"Spores fusoid, $6 \times 1.5 \mu$; sporophores very short."

"On *Rubus fruticosus*." This has been regarded as British on the faith of some specimens collected at Oxford (Baxter), but wrongly so. They are imperfectly developed, with hardly any spores, but do not in any case agree with *Phomopsis*.

87. **Phomopsis vicina**, Grove. *Phoma vicina*, Desm. Exs. ser. ii., no. 352.

"Spores oblong, somewhat curved, without guttules, $5 \times 2 \mu$."

"On decorticated branches of *Sambucus nigra*. Ascot." Desmazières' specimens (l.c.) on *Sambucus* are a true *Phomopsis*, with subfusoid biguttulate spores $7-10 \times 2-2.5 \mu$; sporophores cylindrical or subulate, straight or curved, $15-25 \times 1.5 \mu$. They should be compared with the other species on *Sambucus*, with one of which they are probably identical, but in any case the Ascot specimens are excluded, as not belonging to *Phomopsis*, but probably to *Coniothyrium*.

88. **Phoma Asparagi**, Sacc. in Mich. i. 257.

This is said to be a *Phomopsis*, and American specimens seem to support the claim, but no good British specimens have yet been seen.

89. **Cytospora stictostoma**, Grove in Journ. Bot. 1916, p. 190.

This species presents certain resemblances to a *Phomopsis*, and appears to be intermediate between the two genera. Cf. no. 40.

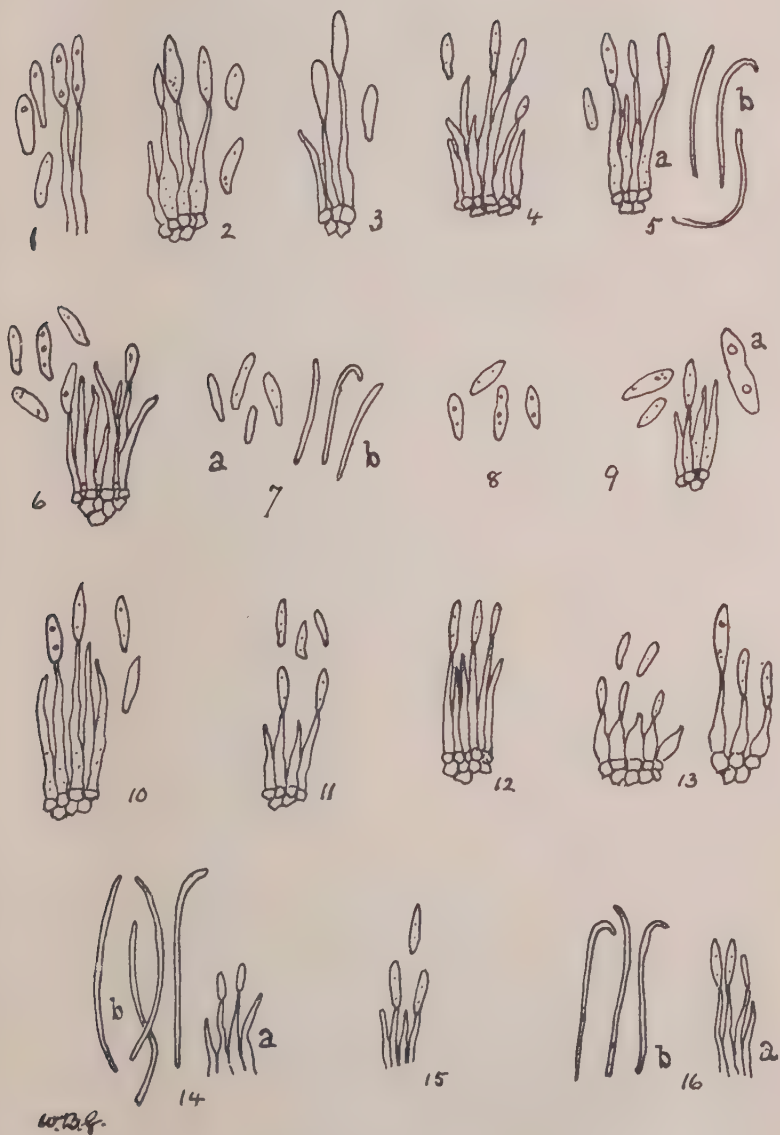
LIST OF HOST-PLANTS.

Abies, 40.	Malva, 35.
Acer, 44, 50.	Menispermum, 36.
Achillea, 1.	Morus, 37.
Aesculus, 16.	Negundo, 31.
Amelanchier, 4.	Neillia, 64.
Arctium, 5.	Papaver, 88.
Aristolochia, 72.	Phaseolus, 42.
Asparagus, 88.	Philadelphus, 30.
Aucuba, 7, 73.	Phytolacca, 68.
Baccharis, 78.	Picea, 40.
Buxus, 65.	Plantago, 67.
Cactus, 9.	Platanus, 53.
Calystegia, 10.	Podophyllum, 45.
Chaerophyllum, 12, 66.	Polygonum, 46.
Cistus, 15.	Prunus, 47.
Cocculus, 36.	Pyrus, 3.
Colutea, 77.	Quercus, 25, 51, 52.
Cornus, 17.	Rhamnus, 24.
Coronilla, 78.	Rhus, 54.
Crucifera, 75.	Robinia, 41.
Cytisus, 57, 66.	Rosa, 27, 43, 56.
Dianthus, 11.	Rubus, 38, 86.
Dipsacus, 20.	Rumex, 22.
Eryngium, 74.	Salix, 59.
Euonymus, 13, 79.	Sambucus, 60, 66, 82,
Ficus, 14.	87.
Fraxinus, 48, 62.	Sarothamnus, 61.
Hedera, 49.	Scrophularia, 39.
Heracleum, 6.	Solanum, 21, 76.
Herminiera, 26.	Sophora, 63.
Hibiscus, 81.	Spiraea, 64.
Humulus, 83.	Staphylea, 55, 84.
Hypochoeris, 2.	Symphoricarpos, 58.
Juglans, 29.	Syringa, 19.
Kerria, 28, 66.	Tamus, 68.
Leontodon, 2.	Tecoma, 85.
Lonicera, 18, 33.	Tilia, 69.
Lysimachia, 34.	Viburnum, 8.
Maclura, 23.	Vinca, 32.
Magnolia, 70.	Vitis, 71.

EXPLANATION OF PLATES.

Fig.

1. P. Achilleae.
2. P. Albicans.
3. P. ambigua.
4. P. Amelanchieris.
5. P. Arctii; a, A-spores; b, B-spores.
6. P. Asteriscus.
7. P. Caeti.
8. P. Caryophylli.
9. P. Celastrinae; a, ? ascospore.



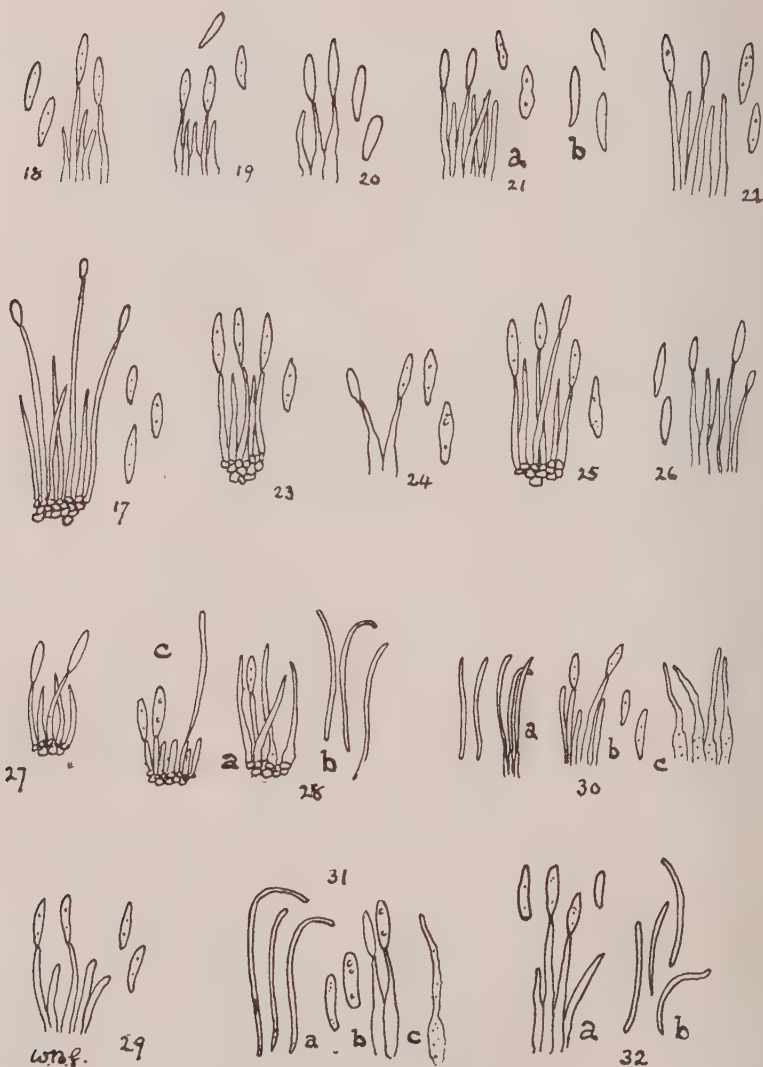


Fig.

10. *P. cinerascens*.
11. *P. Corni*.
12. *P. Dipsaci*.
13. *P. glandicola*.
14. *P. Herminierae*; a, A-spores; b, B-spores.
15. *P. Landeghemiae*.
16. *P. Lonicerae*; a, A-spores; b, B-spores.
17. *P. Menisperm.*
18. *P. moricola*.
19. *P. petiolorum*.
20. *P. Phaseoli*.
21. *P. piceata*; a, spores; b, spores of *C. concava*.
22. *P. Podophylli*.
23. *P. pterophila*.
24. *P. quercella*.
25. *P. Radula*.
26. *P. sambucina*.
27. *P. scobina*.
28. *P. Sorbariae*; a, A-spores; b, B-spores; c, the two, side by side.
29. *P. striaeformis*.
30. *P. velata*; a, B-spores; b, A-spores and c, elongated sporophores of *P. communis*.
31. *P. aucubicola*; a, B-spores; b, A-spores; c, an elongated sporophore.
32. *P. Coronillae*; a, A-spores; b, B-spores.

All the figures are magnified 1000 times.

VII.—ADDITIONS TO THE WILD FAUNA AND FLORA OF THE ROYAL BOTANIC GARDENS, KEW: XV.

Coccidae.

E. ERNEST GREEN.

By the courtesy of the authorities I was permitted to search the plant houses in the Royal Botanic Gardens at Kew, for *Coccidae*, on the 7th of December last. It may be interesting to compare the result of my search with the previous occasion—twenty years ago (in May, 1896)—when I visited the Gardens with a similar object. On that occasion I listed sixteen distinct species, and Prof. Newstead, as the result of a visit in the same year, added six others, making twenty-two species in all. On the present occasion I again found sixteen species (mentioned below); but, of these, three had not previously been recorded from the Gardens (or, indeed, from the British Isles), one of the three being new to science.

On going through these splendid houses, containing countless plants from every part of the world, I had a selfish feeling of disappointment that, owing to the evident care with which the

plants had been tended and doctored, comparatively so few insects were to be found. With the exception of three or four common greenhouse pests, which it is practically impossible to eradicate from any conservatory, the species observed were the result of very diligent search, and were represented by few individuals only.

I append a list of the species taken on this occasion.

1. *Lecanium tessellatum*, *Sign.*

Commonly on various palms. Also on *Tabernaemontana* sp., *Ardisia humilis* and *Ochna pumila*.

2. *Lecanium hemisphaericum*, *Targ.*

On *Carissa* sp. and *Rheedia*.

3. *Lecanium longulum*, *Dougl.*

On *Monodora*, sp., *Treculia*, *Carissa*, and *Excoecaria discolor*.

4. *Lecanium oleae*, *Bern.*

On *Erythrina* sp.

5. *Lecanium nigrum*, (?) var. *depressum*, *Targ.*

Abundantly on *Musa*. More rarely on *Chrysophyllum*, *Mala-cantha*, and *Ficus* spp.

These examples have all the microscopical characters of typical *nigrum*, but have a different external fascies, being of a dull brown colour and less strongly convex than the type.

6. *Lecanium signiferum*, *Green.*

On *Polypodium aurem*.

This insect has hitherto been recorded from Ceylon and India only. It is possible that it may be—as suggested by Sanders—a varietal form of *L. hesperidum*; but, if so, its very characteristic colour pattern (green or olivaceous, with strongly-marked purplish or blackish longitudinal stripe and double transverse bands) make it deserving of a distinct name.

7. *Pulvinaria floccifera*, *Westw.*

On *Cordia* sp.

A common hot-house pest, affecting more particularly orchids of many kinds.

8. *Pseudococcus longispinus*, *Targ.*

This appears to be the most widely distributed Coccid in the Kew houses. Amongst numerous other plants I noted its occurrence on *Musa*, *Cycas*, *Euphorbia*, and *Cotyledon pringlei*.

9. *Pseudococcus citri*, *Risso.*

This usually common greenhouse pest was noticed only on *Solandra* and a species of *Euphorbia*.

10. *Pseudococcus nipae*, *Mask.*

Rather commonly on various palms; more particularly on *Cocos*, *Kentiopsis*, and *Sabal*.

This interesting species has not previously been recorded from the British Isles. Mr. Fryer sent me examples, a few months

ago, taken on an imported palm in a London sale-room, but the insect must have been established at Kew for some considerable time, though unnoticed hitherto. It may be readily recognised by its distinct buff colour and by the compact conical waxy processes on the dorsum.

11. **Diaspis echinocacti**, *Bouche*.

On *Cereus* sp.

12. **Hemichionaspis aspidistrae**, *Sign*.

On *Polypodium aureum*.

13. **Aspidiotus ficus**, *Ashm*.

On *Pandanus*.

14. **Aspidiotus hederæ**, *Vallot*.

On *Euphorbia*, sp. and *Asparagus falcatus*.

15. **Ischnaspis filiformis**, *Dougl*.

Abundant on various palms.

16. **Lepidosaphes** sp. nov. (to be described elsewhere).

On *Nephrodium* sp.

Other records of Coccidae collected at Kew are to be found in Newstead's "Monograph of British Coccidae" and, at rare intervals, in the pages of the "Entomologist's Monthly Magazine." It may be useful to bring together all these records (42 in all, exclusive of indigenous open-air species) in the following list of species that are known to have occurred in the plant houses of the Royal Botanic Gardens.

Icerya aegyptiaca.

Orthezia insignis.

Asterolecanium bambusae.

Coccus tomentosus.

Gymnococcus agavium.

Ripersia filicicola.

Pseudococcus citri, *longispinus*, *nipae*.

Vinsonia stellifera.

Pulvinaria floccifera.

Lecanium hemisphaericum, *nigrum*, *nigrum-depressum*,*
oleae, *hesperidum*, *signiferum*,* *longulum*, *tessellatum* (= *perforatum*).

Pinnaspis buxi (= *pandani*).

Hemichionaspis aspidistrae.

Diaspis boisduvallii, *echinocacti* (= *calyptroides*), *carueli*, *pentagona*, *persimilis*.*

Howardia biclavis.

Aspidiotus ficus, *hederæ*, *personatus*, *spinosus*, *dictyospermi*, *cyanophylli*, *perseae*, *aloes* (probably wrongly determined).

Gymnaspis aechmeae.

Parlatoria pergandei-crotonis.

Fiorinia kewensis.

* (Additions to the list published in the "Wild Fauna and Flora of the R.B.G., Kew") of the Royal Botanic Gardens, Kew, *Kew Bull. Add. Series V.*, 1906, and Additions thereto in *K.B.*, 1907, p. 97, and *K.B.*, 1908, p. 124.

Poliaspis cycadis.

Lepidosaphes pinnaeformis, and *sp. nov*

Ischnaspis filiformis.

VIII.—TREE LABELS AT KEW.

A very noticeable tendency in horticulture previous to the outbreak of war was the growing interest that was being taken in hardy trees. This was evident not only amongst landed proprietors and owners of gardens generally, but equally so in regard to the general public. The ordinary system of labelling the trees at Kew has been to give the botanical name, the popular or English name (if such existed), and the country of which the tree was a native. For those who had access to text-books, this information provided the key to any further knowledge they might desire to obtain about any particular tree or trees. But by far the greater proportion of visitors to Kew do not possess books on trees, and, in view of the growing popular interest in the subject, it seemed desirable to provide a label which, attached to the tree itself, would give a brief and untechnical account of its origin, its history, its economic qualities, and so on.

About eight years ago a commencement was made by printing on cards, 6 in. by 4 in., an account, running to about one hundred words, of the commoner trees. The cards were of green Willesden paper, thin, very hard, and resistant but not impervious to moisture. They were fitted in tin frames painted black with a sheet of glass in front, and the whole nailed to the tree trunks. These card labels thus protected proved to be very satisfactory, and have been much appreciated by the public. In recent years, however, it has been found difficult to keep them in order, on account of the wanton smashing of the glass fronts by mischievous visitors. In number such visitors certainly are very few, and probably young and irresponsible, but unfortunately it is easy for a single person so disposed to break a large number of these glasses. For this reason an unbreakable waterproof covering for the labels was suggested, and a method of treating them was found which has proved satisfactory and is now being generally used.

As these descriptive card-labels have been copied in other public gardens, it has been thought desirable that the following account of their treatment should be published:—

CARD-LABELS AND CELLULOID-VARNISH.

The use of celluloid-varnish as a protective covering on printed card-labels was recommended by Professor C. V. Boys, F.R.S., the object in view being to make the labels resistant to damp, and therefore capable of being exposed to the weather without the protection of a facing of glass.

As an experiment, a considerable number of labels coated with celluloid-varnish have been put into use during the past twelve months, the labels being placed in the same frame-like metal holders as before, but without glass. The outcome of the experiment shows that satisfactory results can be obtained by the use of celluloid varnish made and applied as follows:—

The varnish is made by dissolving celluloid in amyl acetate so as to produce a liquid of about the consistency of thick treacle. The varnish is painted over the front and back of the labels, and is also applied to the edges, a second coat being given after the labels have been allowed to dry. To get a uniform coat, it was found best to let the card lie flat during drying, and consequently only one surface was treated at a time. A third coat of varnish is perhaps usually necessary, but the number of applications required depends on the density of the varnish, the heaviness of painting on, and probably also on the sizing of the card. After the application of two coats, one of the cards should therefore be roughly tested by allowing a pool of water to lie on the face of it for some hours. Strong warping of the card would then indicate that more varnish is required.

In preparing the varnish two forms of celluloid were tried. One of these was obtained under the name of "partially digested celluloid," or "celluloid mass," and was gelatinous in appearance. The results following the use of this substance were not, on the whole, satisfactory; there is therefore no need to refer to it further.

The other material employed was waste celluloid, being, in one case, cuttings from sheet-celluloid, and, in the other, lengths of celluloid ribbon belonging to cinematograph films. To obtain the solution, pieces of celluloid are cut into narrow strips, which are then placed in amyl acetate sufficient in quantity to cover them. The mixture is kept in a closed vessel, and stirred up at intervals of one or two hours. When solution is complete, more celluloid or more solvent is added, as required, and the mixture stirred as before. This is repeated until the right consistency has been reached, the process requiring perhaps three or four days before a suitable strength can be given to the solution. The proportions may be given roughly as one ounce of celluloid to two and a half pounds of amyl acetate.

Labels should be varnished and dried in a well-ventilated place, so as to avoid an accumulation of the vapour of amyl acetate.

IX.—THE STRAWBERRY-RASPBERRY.

(*Rubus illecebrosus*, Focke.)

R. A. ROLFE.

For a good many years a dwarf herbaceous *Rubus* has been in cultivation under the name of the Strawberry-Raspberry. As a drawing has been made for the "Botanical Magazine," and its history has been much confused, the opportunity is taken of clearing the matter up, so far as materials are available.

In an account of the Rubi of Eastern Asia, published in 1871, Maximowicz included under "*R. rosifolius* β *coronarius*" (1) a state "*flore simplici*" and (2) a state "*flore pleno*." Of the former he says that two indigenous forms occur in Japan, an alpine one, which has dwarf annual simple stems, one or two large terminal flowers, and scarlet fruits an inch long. This is the strawberry-raspberry now under discussion, as proved by

a fruiting specimen in the Herbarium collected and named by Maximowicz himself. The locality given is "Ninpon: in declivio continentali vulcani Fudzi-yama, in sylvis; November, 1892." The second form described by Maximowicz "*loci magis demissis calidioribus orta*," as having branched biennial stems and yellow fruits, is quite different, and may be the *K. pungens*, Camb. (Phonzo Zoufou, xxxi. fol. 14, recto), a true *Idaeobatus*, and also a native of the island of Nippon. The double state (2) is the one figured in the "Botanical Magazine" (t. 1783) as *R. rosaefolius* β *coronarius*, Sims. This Maximowicz regards as a "*lusus*" of the single form (1), and he states of it that it is everywhere cultivated in Japanese gardens, and may possibly mature fruit, as perfect reproductive organs are frequently present. It is on the strength of the two single forms mentioned that he adds in the diagnosis of this variety β *coronarius* "*fructo rubro vel luteo succulento*." Maximowicz also cites *Rubus chinensis*, Ser., as a doubtful synonym, but this proves different, as will be seen presently.

Some four years later, Franchet and Savatier enumerated the Strawberry-Raspberry as "*Rubus rosifolius* β *coronarius*," adding the Japanese native name "*Buru itsigo* (Tanaka)," and citing a figure of a flowering specimen in the Japanese work, "*Phonzo Zoufou*," vol. xxv. fol. 15, recto, "*sub Tokouri itsigo*," and a specimen collected by Savatier on Mt. Fuji-yama in this state is preserved at Kew.

In 1898 what is clearly the alpine dwarf form of Maximowicz was figured in the "*Wiener Illustrierte Garten-Zeitung*" as the Japanese Erdbeer-Himbeere, and it is said to have been introduced to cultivation two years previously. In the following year a note was contributed to the "*Gardeners' Chronicle*" by Mr. C. Wolley Dod to the effect that in the previous autumn he received a small plant from a lady, who got it from France under the name of "*Fraisier-Framboisier*," and it was said to be a hybrid between a strawberry and a raspberry. The plant appeared so unlike both reputed parents that Mr. Wolley Dod had sent it to be named, and was told "on good authority" that it was *Rubus rosaefolius*, Smith, a native of Tropical Asia. This determination seems to have been an echo of the original error of Maximowicz.

In 1899 Focke, unaware of its identity with Maximowicz's alpine dwarf form (1) described the same plant as a new *Rubus*, of which he had received flowering and fruiting specimens from Inspector Rettig, of Jena, adding that this was the *R. sorbifolius* of gardens, but not of Maximowicz. The name "*illecebrosus*" was given in allusion to the attractive fruit, and the plant as to habit was compared with *R. xanthocarpus*, Bur. & Franch. Its native country was stated to be probably Japan. In his later Monograph, Focke placed the plant in the section *Idaeobatus* just before *R. rosaefolius*, Smith, and he compared it with *R. fraziniifolius*, Poir., but this is not its proper position, for the drupeoles when mature do not part freely from the persistent receptacle, as in the Raspberry set, but are firmly attached to it, both breaking away together. In fact it belongs to the section *Cylactis*, and to

the small sub-section *Xanthocarpi*, of which *R. xanthocarpus*, Bur. & Franch., is the type. There is an imperfectly described *Cylactis*, also from the island of Nippon, viz., *Rubus minusculus*, Lév. & Van., which was said to differ from *R. pedatus*, Smith, in the non-creeping stem, pinnate leaves with lanceolate sessile incise-denticulate leaflets, somewhat resembling those of a *Sorbus*, and hairy sepals. It was based on a plant collected by Faurie (n. 3187), but unfortunately no specimen is available for comparison. The characters are so much in agreement with *R. illecebrosus* as to suggest that it may be a form of the same species.

The establishment of the synonymy of this plant involved the identity of *Rubus chinensis*, Ser., which Maximowicz doubtfully included under his *var. coronarius flore simplici*. As no specimen was available for comparison, application was made to Dr. C. de Candolle, who has kindly forwarded a life-sized photograph of the original specimen in the Candolle Herbarium, together with fragments of the foliage. The specimen is young, with partially-developed buds, and is clearly an *Idaeobatus*, which matches best *R. Thunbergianus*, Sieb. & Zucc., in fact, the details of shape, venation and texture are quite in agreement. It agrees neither with *R. rosaefolius* nor with *R. illecebrosus*.

R. rosaefolius, Smith (Bot. Mag. t. 6970), is a tropical plant which is not hardy in England, and apart from the different habit and sectional characters above pointed out, it is also readily distinguished by floral characters.

The following is the synonymy of *R. illecebrosus* :—

Rubus illecebrosus, Focke in Abh. Nat. Ver. Bremen, xvi. p. 278 (1899), et in Bibl. Bot., Heft 72, p. 152, fig. 64; Rettig in Die Gartenwelt, iv. p. 233, with fig.; Späth Cat. 1912-13, n. 154, p. 123; Kew Bull. App. 3, p. 74 (1913); Amer. Gard. xxiv. p. 603; Bailey Stand. Cycl. Hort. v. p. 3029, fig. 3497, 3498.

R. rosifolius β *coronarius flore simplici forma altera* (alpina), Maxim. Mél. Bot. viii. p. 388 (1871) et in Bull. Acad. Imp. St. Petersb. xvii. p. 157.

R. sorbifolius, Hort. ex Focke in Abh. Nat. Ver. Bremen, xvi. p. 278 (non Maxim.).

R. rosifolius β *coronarius*, Franch. et Sav. Enum. Pl. Jap. i. p. 126, in part (non Smith).

R. rosaefolius γ *coronarius a simpliciflora*, Makino in Tokyo Bot. Mag. xv. p. 52 (1901); Matsum. Ind. Pl. Jap. p. 236 (in part).

R. rosaefolius, Wolley Dod in Gard. Chron. 1899, xxvi. p. 240; J. H. Wilson in Journ. Hort. Soc. Genet. pp. 207, 208, fig. 49 B.* (non Smith).

Erdbeer-Himbeere, Wien. Ill. Gart. Zeit. 1898, pp. 75, 77, fig. 22.

Strawberry-Raspberry, Gard. Chron. 1898, xxiii. p. 139; 1909, xli. p. 403; Garden, 1903, lxiv. pp. 275, 353, 411, 412, with fig.

ICON. JAP. Phonzo Zoufou, xxv. fol. 15, recto.

* The parentage of the hybrid described and figured here by Wilson (fig. C) now requires to be amended to *R. occidentalis* \times *illecebrosus*.—R. A. R.

X.—NEW ORCHIDS: DECADE XLV.

441. **Pleurothallis** (§ **Apodae caespitosae**) **costaricensis**, Rolfe; affinis *P. longissimae*, Lindl.; sed foliis minoribus, sepalis lateralibus connatis apice minute denticulatis differt.

Herba epiphytica, caespitosa; caules secundarii nulli. *Folia* breviter petiolata, anguste oblanceolato-oblonga, subobtusata, coriacea, 4–5 cm. longa, 0·5–0·6 cm. lata, basi attenuata. *Scapi* elongati, 12–15 cm. longi, basi vaginis spathaceis brevibus paucis obtecti; racemi 7–10 cm. longi, multiflori. *Bracteae* ovatae, acutae, circiter 1·5 mm. longae. *Pedicelli* graciles, 3 mm. longi. *Sepala* conniventia, circiter 0·9 cm. longa; posticum lanceolatum, acuminatum; lateralia connata, lanceolata, acuminata, apice minute bidentata. *Petala* linearia, subacuta, 2 mm. longa. *Labellum* pandurato-oblongum, obtusum, 2 mm. longum. *Columna* oblonga, marginata, 2 mm. longa.

CENTRAL AMERICA. Costa Rica, near Cachi, C. H. Lankester 21.

Sent to Kew by Mr. C. H. Lankester, in 1915, and flowered in the collection in May, 1916. The flowers are light greenish yellow, with rather darker nerves and lip.

442. **Cirrhopetalum longidens**, Rolfe; habitu *C. picturato*, Lodd., subsimile, sed sepalo postico non setifero et columnae dentibus multo longioribus et medio oblique auriculatis facile distinguendum.

Herba epiphytica. *Rhizoma* validum, repens. *Pseudobulbi* subapproximati, ovoidei, 1·5–2 cm. longi, monophylli, basi vaginis membranaceis obtecti. *Folia* elliptico-oblonga, obtusa, 5–11 cm. longa, 2·5–3 cm. lata, coriacea, basi attenuata. *Scapi* deflexi, graciles, circiter 18 cm. longi, pauciflori, vaginis spathaceis paucis obtecti. *Bracteae* ovato-lanceolatae, acuminatae, 0·6–0·8 cm. longae. *Pedicelli* circiter 2 cm. longi. *Flores* mediocres. *Sepalum* posticum elliptico-oblongum, subapiculatum, minute denticulatum, concavum, 1·3 cm. longum; sepala lateralia connata, elongato-oblonga, subobtusata, 2–2·5 cm. longa. *Petala* elliptico-oblonga, subobtusata, spinuloso-ciliata, 0·8 cm. longa, facie papillosa. *Labellum* recurvum, carnosum, deltoideo-oblongum, subobtusum, 0·8 cm. longum. *Columna* lata, 3–4 mm. longa; dentes falcati, 0·5 cm. longi, medio oblique auriculati, apice graciliter subulati.

HABITAT UNKNOWN.

Flowered in July, 1916, in the Kew collection, where it has been for a considerable time as a small plant, but its origin cannot be traced. The flowers are yellow, with red-brown markings on the petals, dorsal sepal and base of the lateral sepals, while the lip is darker yellow. The species is remarkable for the length and shape of the teeth of the column.

443. **Eria** (**Cylindrolobus**) **albolutea**, Rolfe; ab *E. brachystachi* Reichb. f., foliis latioribus, floribus minoribus et labelli lobo intermedio cum carina pulvereo-puberulo differt.

Herba epiphytica. *Pseudobulbi* cylindrici, elongati, 25-30 cm. longi, 0·8 cm. lati, foliacei. *Folia* disticha, lanceolata vel lineari-lanceolata, breviter et oblique bidentata, subcoriacea, 6-10 cm. longa, 0·9-1·2 cm. lata. *Scapi* axillares, breves, uniflori, 4-5-bracteati. *Bracteae* petaloideae, lineari-oblongae, subacutae, 1-1·5 cm. longae, pallide luteae. *Pedicelli* 1 cm. longi, glabri. *Sepalum* posticum lineari-oblongum, obtusum, subundulatum, concavum, 1·3 cm. longum; sepala lateralia ovato-oblonga, obtusa, subundulata, concava, 1-1·2 cm. longa, basi mentum obtusum 4 mm. longum formantia. *Petala* subfalcata, lineari-oblonga, obtusa, subulata, concava, 1 cm. longa. *Labellum* trilobum, 0·7-0·8 cm. longum; lobi laterales suborbiculares, obtusi, 2 mm. longi; lobus intermedius ovatus, obtusus, pulvereo-puberulus, 3 mm. longus; discus prominenter carinatus, pulvereo-puberulus. *Columna* clavata, marginata, 4-5 mm. longa.

PHILIPPINES.

Flowered in the Royal Botanic Gardens, Glasnevin, in August, 1916. The flowers are pure white, with the petaloid bracts light yellow.

444. ***Epidendrum* (*Amphiglottium*) *tricarinatum*, Rolfe;** habitu et floribus *E. erecto*, Hook. f., subsimile, sed labelli disco tricarinato facile distinguendum.

Caules erecti, elongati, teretes, 0·75-1 m. alti, inferne distichophylli, superne vaginis tubulosis imbricatis obtecti. *Folia* sessilia, oblonga vel lanceolato-oblonga, subobtusa, crassocoriacea, 4-9 cm. longa, 1·3-1·8 cm. lata. *Flores* breviter racemosi, multiflori. *Bracteae* lineari-lanceolatae, acutae, 0·5-1·5 cm. longae. *Pedicelli* 2-2·5 cm. longi. *Sepala* elliptico-oblonga, subacuta, 1-5 cm. longa. *Petala* elliptico-lanceolata, subacuta, 1·4 cm. longa. *Labellum* columnae omnino adnatum, trilobum; lobi laterales oblique cuneati, 5-6 mm. longi, apice fimbriati; lobus intermedius obcordato-bilobus, 0·9 cm. longus, apice fimbriatus; discus prominenter tricallosus; calli laterales denticulati; callus intermedius integer. *Columna* 0·5-0·6 cm. longa.

PERU. *L. Forget.*

Introduced by Messrs. Sander and Sons, St. Albans, and flowered at the Royal Botanic Gardens, Glasnevin, in June, 1916, when it was sent for determination by Sir Frederick W. Moore. Though bearing a general resemblance to *E. erectum*, Hook. f. (Bot. Mag. t. 5902), it is readily distinguished from its allies, in having the crest of the lip arranged in three thickened keels, the median one extending nearly to the division of the front lobe, and the lateral pair being shorter and crenulate. The flowers are bright purple, and the keels whitish at first, but afterwards suffused with purple.

445. ***Eulophia triloba*, Rolfe;** habitu *E. purpurascens*, Rolfe, similis, sed labello profunde trilobo et lobis longioribus differt.

Folia 3-4, fasciculata, elongato-linearia, acuta vel acuminata, 20-30 cm. longa, 4-6 mm. lata. *Scapi* erecti, 40-45 cm. longi, subgraciles, vaginis lanceolatis obtecti; racemi 4-6 cm. longi;

laxi, pauciflori. *Bracteae* ovato-lanceolatae, acuminatissimae, 8–13 mm. longae. *Pedicelli* graciles, circiter 1 cm. longi. *Sepala* subconniventia, lanceolato-linearia, acuta, 2 cm. longa. *Petala* elliptico-oblonga, apiculata vel acuta, 2 cm. longa, 6–7 mm. lata. *Labellum* trilobum, 1.7–2 cm. longum; lobi laterales triangulari-oblongi, subobtusius, subdivergentes, 6 mm. longi; lobus intermedius obovato-oblongus, apiculatus, 1 cm. longus, dense papilloso-cristatus; discus basi 3-carinatus; calcar clavato-oblongum, obtusum, 7 mm. longum. *Columna* clavata, 8 mm. longa.

SOUTH AFRICA. Natal; Ginginhlova, 0–70 m., Haygarth, in *Herb. Wood* 11785.

446. ***Eulophia elegantula***, Rolfe; affinis *E. ovatipetalae*, Rolfe; sed humilior, petalis angustioribus et labelli calcar brevius facile distinguenda.

Folia fasciculata, linearia, acuminata (immatura). *Scapi* 25–40 cm. alti, vaginis paucis spathaceis obtectis; racemi 4–8 cm. longi, laxiflori. *Bracteae* ovatae vel ovato-lanceolatae, acuminatae, 6–12 mm. longae. *Pedicelli* subgraciles, 1.5–2 cm. longi. *Sepala* lanceolato-oblonga, subacuta, 1.5 cm. longa. *Petala* elliptico-oblonga, obtusa, 1.3 cm. longa. *Labellum* 3-lobum, 1.2 cm. longum; lobi laterales suborbiculari-oblongi, obtusi, breves; lobus intermedius obovato-oblongus, obtusus, convexus, carinatus, 7–8 mm. longus; discus striatus et obscure verrucosus; calcar conicum, subobtusum, strictum, 5–6 mm. longum. *Columna* clavata, 8 mm. longa.

SOUTH AFRICA. Natal; Gillitts, 650 m., *J. Medley Wood* 11789.

A dwarf species, bearing a tuft of short, straight leaves at flowering time. The flowers are described as brown and yellow.

447. ***Eulophia obcordata***, Rolfe; *E. hyanti*, Spreng., similis, sed labello crassiusculo, disco 5–7 carinato et tuberculis crassiusculis differt.

Folia fasciculata, linearia, acuminata (immatura). *Scapus* erectus, circiter 30 cm. altus, vaginis paucis spathaceis obtectis; racemus circiter 7 cm. longus, laxiflorus. *Bracteae* elliptico-lanceolatae, acutae, 8–12 mm. longae. *Pedicelli* graciles, 1–1.5 cm. longi. *Sepala* oblonga, apiculata, 1.2 cm. longa. *Petala* elliptico-oblonga, apiculata, 1.2 cm. longa. *Labellum* 3-lobum, 1.2 cm. longum; lobi laterales breves, triangulari-oblongi, subacuti, divergentes, 2–3 mm. longi; lobus intermedius late obcordato-oblongus, 6–7 cm. latus, subundulatus; discus 5–7-carinatus, carinis tuberculis crassiusculis instructis; calcar filiforme, obtusum, incurvum, circiter 6 mm. longum. *Columna* clavata, 6 mm. longa.

SOUTH AFRICA. Natal; Gillitts, 700 m., *J. Medley Wood* 11789a.

Near *E. hians*, Spreng., but the differently shaped bracts and lip, with more numerous keels and thicker texture, serve to distinguish it. It was found mixed with the preceding species.

448. **Eulopia durbanensis**, Rolfe; affinis, *E. papillosae*, Schlecht., sed floribus crassiusculis et labelli lobis lateralibus minoribus differt.

Folia 3-4, fasciculata, elongato-linear, acuta vel acuminata, striata, 30-40 cm. longa, 4-7 mm. lata. *Scapi* erecti, 45-55 cm. alti, vaginis elongatis acuminatis imbricatis obtecti; racemi 6-9 cm. longi, sublaxi, multiflori. *Bractee* lineari-lanceolatae, acuminatissimae, 1-1.2 cm. longae. *Pedicelli* graciles, 1-1.5 cm. longi. *Sepala* ovato-oblonga, subobtusa vel apiculata, circiter 1 cm. longa. *Petala* elliptico-ovata, obtusa vel apiculata, 9 mm. longa. *Labellum* late obovato-oblongum, 1 cm. longum; lobi laterales oblique ovati, obtusi, 3 mm. longi; lobus intermedius obovatus, retusus, 5-6 mm. longus; discus papillis brevibus numerosis instructus, prope basin bicarinatus, carinis brevibus elevatis. *Columna* clavata, 6 mm. longa.

SOUTH AFRICA. Natal; near Durban, 0-90 m. *J. Medley Wood* 11775.

449. **Maxillaria Shephardii**, Rolfe; affinis *M. Parkeri*, Hook., sed sepalis multo angustioribus et petalis immaculatis facile distinguenda.

Herba epiphytica. *Pseudobulbi* aggregati, late ovoidei vel interdum obovoidei, depressi vel subtruncati, 1.5-2 cm. longi, monophylli, basi vaginis membranaceis obtecti. *Folia* petiolata, elliptico-oblonga, subobtusa, coriacea, 10-23 cm. longa, 3.5-6 cm. lata; petioli conduplicati, 2-5 cm. longi. *Flores* numerosi, erecti; pedicelli 4.5-6 cm. longi, vaginis tubuloso-spathaceis subimbricatis obtecti. *Bractee* spathaceae, lanceolato-oblongae, subacutae, circiter 1.5 cm. longae. *Sepala* subpatentia, anguste lanceolato-oblonga, subobtusa, 2-2.3 cm. longa, lateralia in mentum brevem obtusum extensa. *Petala* lineari-oblonga, subobtusa, 1.8 cm. longa. *Labellum* 1.2 cm. longum, trilobum; lobi laterales anguste oblongi, obtusi vel subtruncati; lobus intermedius elliptico-ovatus, obtusus, crassiusculus, 4 cm. longus; callus lineari-oblongus, obtusus, prope apicem incrassatus. *Columna* clavato-oblonga, 8 cm. longa; alis denticulatis.

COLOMBIA. Rio Condoto, Chcco District, *Dr. S. Shephard*.

Acquired for Kew in 1914, from Mrs. Shephard, Abbots Hall, Aylsham, and flowered in the collection in July, 1916. The flowers are produced in profusion from beneath the pseudobulbs, and have rather short pedicels. The sepals are deep yellow, somewhat suffused with brownish-red towards the apex, the petals yellowish white, and the lip yellow, striped with light red on the disc and side lobes, with the apex of the crest orange-red.

450. **Dichaea ciliolata**, Rolfe; affinis *D. hystricinae*, Reichb. f., sed foliis latioribus et fere duplo brevioribus differt.

Herba epiphytica, erecta, nana, ramosa. *Caulis* subcompressus, distichophyllus, pallide viridis. *Folia* sessilia, patentia, ovata vel anguste ovata, mucronata, ciliolata, 0.3-0.4 cm. longa, apice recurva, basi amplexicaulia. *Flores* axillares; pedunculi graciles, 0.8 cm. longi, uniflori. *Bractee* late ovatae, apiculatae,

membranaceae, 1 mm. longae. Ovarium breve, longe hirsutum, pilis crassiusculis et patentibus. *Sepala* subpatentia et paullo incurva, lanceolato-oblonga, subacuta, 0·7–0·8 cm. longa. *Petala* subpatentia, elliptico-lanceolata, subacuta, 0·7–0·8 cm. longa. *Labellum* breviter unguiculatum, subincurvum, hastato-trilobum, prope basin angulatum, 0·7 cm. longum; lobi laterales falcato-oblongi, incurvi, 3 mm. longi; lobus intermedius ovatus, subobtus, apice paullo recurvus. *Columna* clavato-oblonga, 0·5 cm. longa, rostellum oblongum, pubescens, violaceum.

CENTRAL AMERICA. Costa Rica, near Cachi, *C. H. Lankester* 12.

Sent to Kew by Mr. C. H. Lankester in 1915, and flowered in the collection in July, 1916. The flowers are pale buff with red-purple spots and bars, the lip white with purple spots and a similar suffusion on the side lobes, the column pale buff margined with dull purple, and the rostellum violet.

XI.—MISCELLANEOUS NOTES.

We note with pleasure in the recently issued list of New Year Honours the names of DR. FRANCIS WATTS, Imperial Commissioner of Agriculture for the West Indies, and DR. LEONARD ROWAY, Government Botanist, Tasmania, both of whom His Majesty has been graciously pleased to appoint to be Knights Commander of the Most Distinguished Order of St. Michael and St. George.

GEORGE EDWARD MASSEE.—Rather less than two years ago it was our pleasant task to give, in the pages of the *Kew Bulletin*, a notice of the life and work of Mr. G. Massee on the occasion of his retirement. We have now the sad duty of recording his death, which occurred after a short illness at Sevenoaks on February 17th, 1917.

After his retirement on March 31st, 1915, Mr. Massee removed to Park Place, Sevenoaks, where he busied himself with gardening and other pursuits. He also investigated the mycology of the district, and had suggested the holding of a fungus foray in that neighbourhood in the autumn of the present year.

George Massee was a Yorkshire man, being born at Scampston about the year 1850. For a general account of his life, his scientific work, and his skill as an artist, the former article (*K.B.* 1915, pp. 118–120), must be consulted. A few additional lines as to his career may, however, be added since Mr. Massee was not only one of the great men of Kew, but was known the world over as an authority on fungi.

His earlier work on fungi was almost entirely from the morphological and systematic standpoint, his later work and that by which he is most widely known in this country, was largely on plant diseases. But if the latter subject attracted him and appealed most to the general public, his systematic work was on the whole the more important and will find a more permanent place in the history of mycology.

Massee formed an interesting link between the older generation of mycologists, typified by the great master Fries of Sweden, and Berkeley, Cooke and Worthington G. Smith in England (the last-named of whom is happily still living), who relied largely on external morphology, and the modern school to whom the advantages of a training in refined microscopic technique and methods of pure culture have meant so much. In his older systematic works Massee broke new ground and fearlessly adopted microscopic characters as the distinctive features of certain difficult genera. In his pathological work he soon appreciated the value of pure culture and detailed microscopic examination, and adapted himself considerably in investigation along those lines. The advances made in methods of culture and inoculation have been so great and varied during the last ten, or even five, years, that in judging his work, allowance for this fact should always be made.

Massee was always a man of energy and enthusiasm. He was largely instrumental in founding the British Mycological Society, and became its first President. In later years he was a regular attendant of the Fungus Foray of the Yorkshire Naturalists' Union, and was for many years President of the extremely active Mycological Committee of that Society, Charles Crossland, his pupil of former days, whose death was recently noted in the *Bulletin*, being the Secretary. To beginners who showed genuine interest, Massee gave ready help and advice. The writer first visited him at the Herbarium in 1901 with a collection of fungi from the old Royal Horticultural Society's garden at Chiswick. Massee was enthusiastic and inspiring, the collection was promptly named, and the invitation given to come again. That was the first of many visits, and the writer is glad to have this opportunity of acknowledging his indebtedness to the help and kindness received from that day onward. Massee was a remarkable personality. Though quick and shrewd, and often very outspoken, he was kindhearted. His sense of humour and breezy sayings were fully appreciated in the Herbarium, and his presence was greatly missed on his retirement.

On giving up his official duties, Massee resigned his Fellowship of the Linnean Society, but had the honour of being elected an Associate the following year. The most important of his works are mentioned in the article already referred to, a full list of his publications, as far as can be ascertained, has been prepared and will, it is hoped, be published at some later date.

A. D. C.

The late Prof. H. H. W. Pearson.—In the List of Publications by the late Prof. H. H. W. Pearson given in *K.B.*, 1916, p. 279, the reference Trans. Linn. Soc. ser. 2, viii. 311-332, tt. 31-32, should be added to the last paper in the List (Notes on the Morphology of Certain Structures concerned in Reproduction in the Genus *Gnetum*).

The Ross Orchid Drawings.—Through the kindness of the Bentham Trustees, Kew has acquired a valuable collection of Orchid paintings in water colour, made by Mrs. Janet Ross,

widow of the late H. J. Ross, Esq., Poggio Gherardo, Florence, Italy, formerly of Castagnolo, between Pisa and Florence. Mr. Ross, who was an ardent collector of Orchids, was for many years a correspondent of Prof. H. G. Reichenbach, of Hamburg, and as many of the drawings were made by Mrs. Ross from materials authenticated by the latter, they possess a historical value in addition to their artistic merit. They also correspond in a good many cases with materials preserved at Kew, for after Reichenbach's death, in 1889, Mr. Ross sent much valuable material to Kew. The drawings are about 750 in number, and are very faithfully executed. They represent for the most part such species as can be grown in the climate of Florence, and include a good many from Upper Burma, which were brought home by a friend from Mandalay, and formed the nucleus of the collection. Others were subsequently added, until the collection became one of the finest in Italy, numbering nearly one thousand species. Florence is too hot in summer for the cooler-growing species of the American Cordilleras, though some of them are represented in the collection, drawn from plants introduced by Mr. Ross, which generally flowered once and then rapidly deteriorated and died.

Among drawings of the original type-specimens in the collection may be mentioned *Coelogyne Rossiana*, Reichb. f., a Burmese species that flowered in the collection in 1884; *Paphinia cristata* var. *Modigliani*, Reichb. f. (*Lindenia*, t. 117), an albino of a highly-coloured species; *Dendrobium strebloceras* var. *Rossianum* (*Lindenia*, t. 124), another albino; *Peristeria Rossiana*, Reichb. f., a species of doubtful origin that flowered in 1889; *Cynoches Rossianum*, Rolfe, a Central American species which produced a raceme of male flowers in 1889, and shortly afterwards, the large solitary female flower on the same plant; and *Lycaste Rossiana*, Rolfe, another Central American plant. Probably the most interesting drawing in the collection is one of *Cynoches Warscewiczii*, Reichb. f., representing an inflorescence with five female flowers at the base, and over a dozen of the much smaller and very different males above. The actual specimen was sent to Kew by Mr. Ross and is preserved in the Herbarium. Its history is given in the "Orchid Review," vol. iii. p. 263. There are also paintings of four very diverse forms of *Lycaste Janetae*, a hybrid between the orange-yellow *L. Rossiana* and the rose-coloured *L. Skinneri*, Lindl., showing an amount of segregation of character that is very rarely seen among primary hybrids. Another series shows a remarkable case of hybrid sporting in the dark purple-brown *Cypripedium Dauthieri*, a hybrid between *C. barbatum* and *C. villosum*. This first produced a sport irregularly striped and banded with purple-brown and green, which Reichenbach called var. *Rossianum*, and another harlequin-coloured sport, half greenish-yellow and half chestnut that was called var. 'Janet Ross', while still later a greenish-yellow form appeared which was called var. 'Poggio Gherardo', a change that may be roughly compared with an elimination of the purple colour of *C. barbatum*, leaving the colour of *C. villosum*, but retaining the hybrid character in other

respects. The collection forms a valuable accession to the Herbarium.

It may be added that an account of the early life of Mr. Ross is given in a work entitled "Letters from the East," by Henry James Ross, 1837 to 1857, and a Biographical notice in "Orchid Review," vol. x. pp. 282-284, while an account of the collection as it was preserved by Mrs. Ross is given in "Orchid Review," vol. xix. pp. 202-205, and of the garden generally in the "Gardeners' Chronicle" for 1912 (May 11th, p. 345).

R. A. R.

Mycological Collection of Dr. J. W. Ellis.—About three years ago the Herbarium at Kew was enriched by the acquisition of the collection of specimens and drawings of fungi made by the late Mr. C. Crossland. This British collection has now received a further valuable addition in the mycological collection of the late Dr. J. W. Ellis, which has been acquired by purchase. The collection comprises nearly 1600 dried specimens, representative of all groups of fungi. It is especially rich, however, in micro-fungi, in which Dr. Ellis was keenly interested, and includes a series of well-mounted specimens of those of economic importance. There are in addition 330 microscopic slides, which form a welcome addition to the Kew collections.

Olearia dentata and O. tomentosa.—In the *Flora Australiensis*, vol. iii. p. 472, these two species were regarded by Bentham as being identical. They are, however, quite different as here shown, and as one of them, *O. tomentosa*, is in cultivation, it seems desirable that their distinguishing features should be recorded.

O. dentata, Moench, was founded on *Aster dentatus*, Andr. Bot. Rep. t. 61 (1797), where it is well figured; whilst *O. tomentosa* was clearly depicted and described by Schrader in Wendl. Sert. Hann. 8, t. 24 (1798).

The diagnostic features and synonymy of the two species are as follows:—

O. dentata, Moench, Meth. Suppl. p. 254 (1802).

Folia ovata vel ovato-rotundata, sinuato-dentata vel crenata, involucri bracteae extra fere glabrae, apice breviter ciliatae. —Benth. Fl. Austral. vol. iii. p. 472, partim. *Aster dentatus*, Andr. Bot. Rep. t. 61 (1797); non Thunb. *Aster ferrugineus*, Wendl. in Flora, 1819, p. 676. *Diplopappus rotundifolius*, Less. in Linnaea, vol. vi. p. 116 (1831). *Olearia rotundifolia*, DC. Prodr. vol. v. p. 271 (1836).

DISTRIB.—New South Wales: near Port Jackson, *Gaudichaud*; *Clowes* 260; *Fraser*; *Sieber* 341; *R. Brown* 2230; *Hooker*; *Herb. Forsyth.* Richmond River, *C. Moore.* Illawarra, *Backhouse.*

O. dentata was first grown in this country by Messrs. Lee & Kennedy, the Hammersmith Nurserymen, who raised it in the year 1793 from seeds collected in the vicinity of Port Jackson, New South Wales. It seems to have gone out of cultivation.

O. tomentosa, DC. Prodr. vol. v. p. 252 (1836).

Folia plerumque obovata, subintegra vel undulata; involucri bracteae dense et molliter tomentosae.—*Aster tomentosus*, Schrad. in Wendl. Sert Hann. 8, t. 24 (1798). *Olearia dentata*, Benth. Fl. Austral. vol. iii. p. 472, partim; non Moench.

DISTRIB.—New South Wales: Port Jackson, *Cunningham*; *R. Brown* 2231.

Cultivated in the Hanover Garden in 1798; Schrader (l.c.) gives the habitat as “Caput bonae spei,” but this was no doubt a mistake. The species was grown outdoors in the Scilly Islands in 1872, and it probably still grows there, for the cultivated plants in the Temperate House at Kew were obtained from Major Dorrien Smith in 1911 under the name *O. dentata*.

The species of *Olearia* are best classified by the structure of the hairs on the under-surface of the leaves, the different types of hairs being simple, T-shaped, stellate, woolly, or viscid, and the groups defined in this way are remarkably natural and easily recognised. Both the species under discussion have the T-shaped 1-celled hairs which are characteristic of the section *Dicerotriche*. In *O. dentata* the branches of the hairs are very long with the stalk about half as long, whilst in *O. tomentosa* the branches are not so long and the stalk is scarcely a quarter of their length.

J. H.

